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AMERICAN MACHINIST

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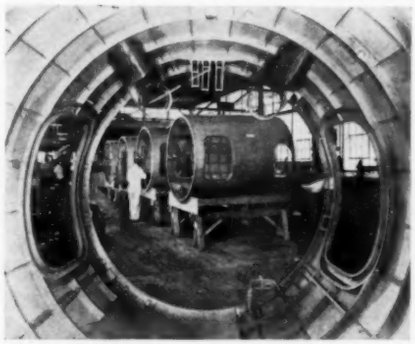

Roomy—*Size of the new Boeing flying boats is reflected by these engine nacelles in which two mechanics can work at once*

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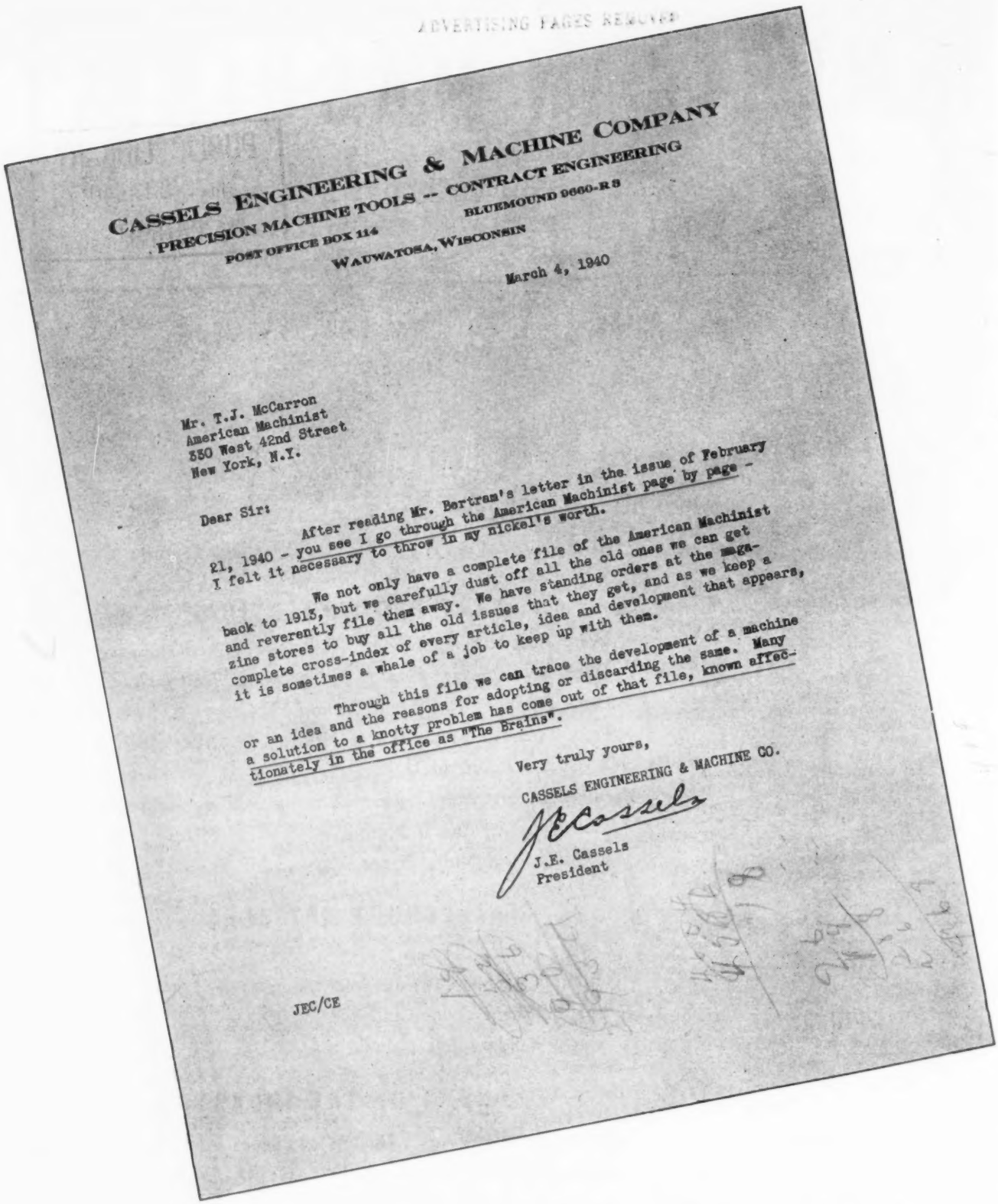

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March 4, 1940

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Dear Sir:

21, 1940 - you see I go through the American Machinist page by page - I felt it necessary to throw in my nickel's worth.

We not only have a complete file of the American Machinist back to 1915, but we carefully dust off all the old ones we can get and reverently file them away. We have standing orders at the magazine stores to buy all the old issues that they get, and as we keep a complete cross-index of every article, idea and development that appears, it is sometimes a whale of a job to keep up with them.

Through this file we can trace the development of a machine or an idea and the reasons for adopting or discarding the same. Many a solution to a knotty problem has come out of that file, known affectionately in the office as "The Brains".

Very truly yours,

CASSELS ENGINEERING & MACHINE CO.

J.E. Cassels
President

JEC/CE

"... you see I go through the American Machinist page by page ..."

WHAT'S IN THIS ISSUE

PLANE FACTS

Back in the early twenties few pilots saw much future in commercial aviation. Most of them operated Jennies from cow pastures, taking up local daredevils at five bucks a head, hopping to the next town when business fell off. They autographed snapshots for the high-school kids, impressed their older sisters by insisting they expected to get killed "any day now."

Miraculously, few of them did. Most got married, settled down when the Jennies gasped their last, got going in some other business. But not all. Some regarded aviation as a potential method of transportation. Back during the Florida boom Curtiss flying boats were ferrying tycoons and playboys between Miami Beach and Palm Beach, even Nassau. Cuba was next. By the time the boom had collapsed flying as a means of transportation was with that corner of the country to stay.

Came the famous Ford trimotors, and a daring young man who pressed *them* into service between Miami and Havana, coaxing them across a hundred miles of open water. Next came Sikorsky with his amphibians, then a clipper—and by that time the daring young man was flying all around the Carribbean. Then more and better planes. Vastly improved operating technique. Smart deals with Latin American governments. And while other airlines were still arguing about parachutes, there suddenly burst upon the public consciousness a mature, ocean-spanning airline, operated more like a steamship line, with Miami as its U. S. terminus. That line was Pan American; the daring young man was Juan Trippe, its president.

From that point on Pan American's every move has been very much in the public eye. The spanning of the Pacific, the conquest of the Atlantic have been duly and dramatically detailed in the popular press. But few people realize the part played by the manufacturing technique which makes possible the very existence of the spectacular ships. Even the airline operators themselves take it for granted that plane makers can produce any ship engineers can design. Maybe they can, maybe not. Boeing probably comes as near to it as anyone. But not on a mass-production basis like Ford, as the newspapers would have you believe. How that organization does put planes together we reveal in five pages jammed with interesting information, fascinating facts, *not* ridiculous rumors. Just turn the page.

WALTER KASSEBOHM

CLEAN FUN

If you don't chuckle at least twice when you spot page 160 you're not human. Those cartoons are our idea of a lot of clean fun. (Yes, pun intentional.) And if you stop and read the captions you won't have to be told there's plenty of hard-down horse sense in them. We'll be mighty surprised if we don't see those pages tacked up on a bulletin board in the next shop we get into. Frankly, there are mightly few we've been through lately that wouldn't benefit from at least one of those ideas.

ROBERT C. GIBBONS

OUNCE OF PREVENTION

If there weren't troubles it wouldn't be a shop. Press work is no exception. Especially where precise duplication is required on long runs, you can expect lots of different kinds of trouble. Walter Kassebohm, who is superintendent of the tool division of Marchant Calculating Machine Company, probably has had as much experience with press-work troubles as anyone you'd be likely to find. On page 164 he tells some of the things that go wrong, how to fix them, and —best of all—how to prevent them in the first place.

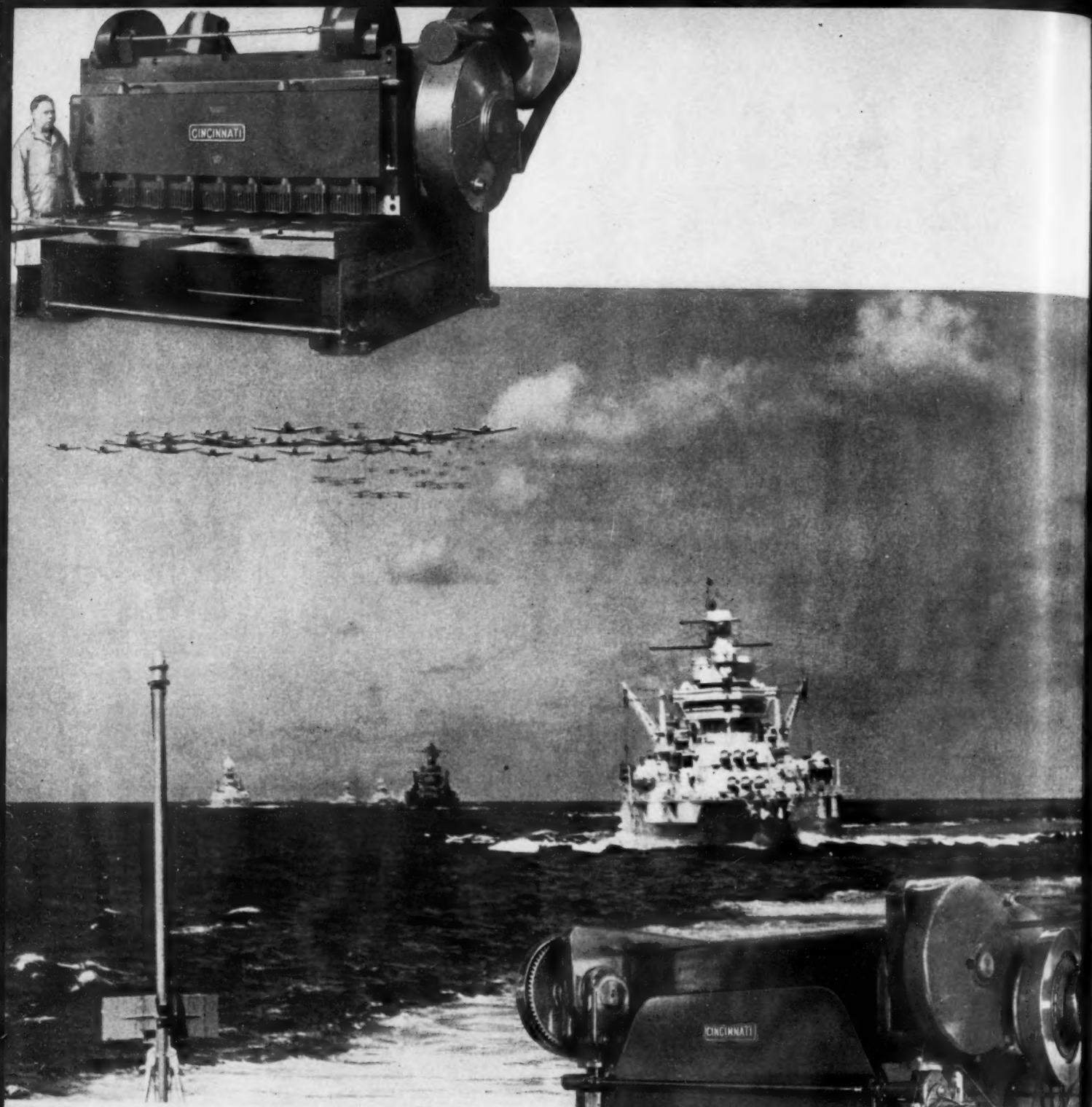
—WITH BUT A SINGLE THOUGHT

We'll bet you'd have a hard time thinking of two departments whose interests are further apart than the machine shop and the laboratory. That's why you'll be interested, and maybe a bit surprised, by the information in the story starting on page 170. In it Robert C. Gibbons tells how laboratory technique has been adapted to help shop practice, especially when it comes to precision measurements. Mr. Gibbons is associated with International Harvester in its Milwaukee plant, and is in a fine position to tell how the arrangement works out in actual shop practice. It's an excellent example of the advantages sometimes to be gained from close cooperation between two apparently unrelated departments—of two "minds" with but a single thought, if you will.

COMING

Praise the profilometer! For it permits surface quality to be measured in actual numbers, the art of surface finishing to be reduced to an exact science. With fine finish becoming an increasingly important part of metalworking, we feel it's high time for an article explaining just what *is* surface quality. It will be in an early issue.

Stainless steel is a material many shops shy away from because they find it hard to work. But it's all in knowing how. So we've prepared an article on machining stainless containing a vast amount of hard-to-get information boiled down into concise, usable form. Look for it soon in AMERICAN MACHINIST.



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IN BUILDING SHIPS FOR SKY and SEA . . .

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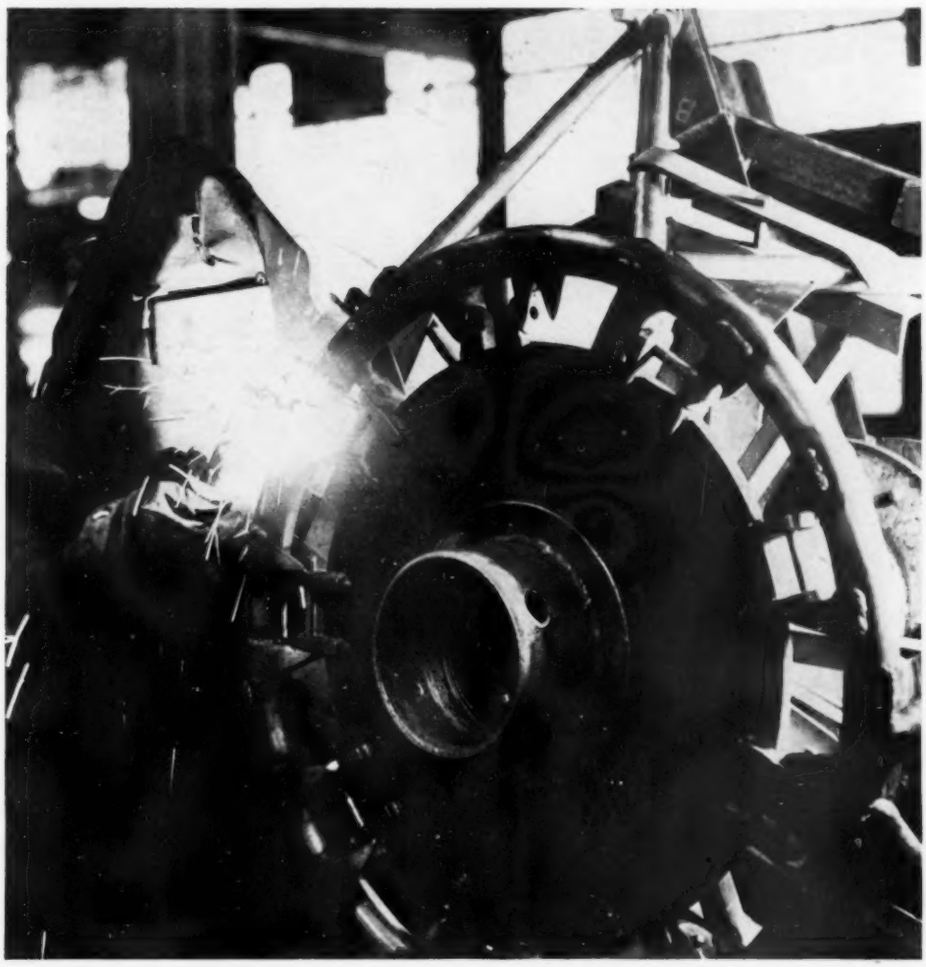


A steel jig rigidly holds the clips in place while they are arc welded to the engine mounting rings

More clippers for the Atlantic

New problems in machining, forming and assembly solved by Boeing in building world's largest commercial planes

THE WAR has so increased the need for rapid transportation of mail and passengers across the North Atlantic that Boeing is rushing manufacture of more Clippers. These Boeing A-314 flying boats, now being built at Seattle, Washington, for Pan-American Airways, are the largest commercial planes ever produced. Their parts are of massive bulk and weight; many of them present new problems of machining, forming and assembling.

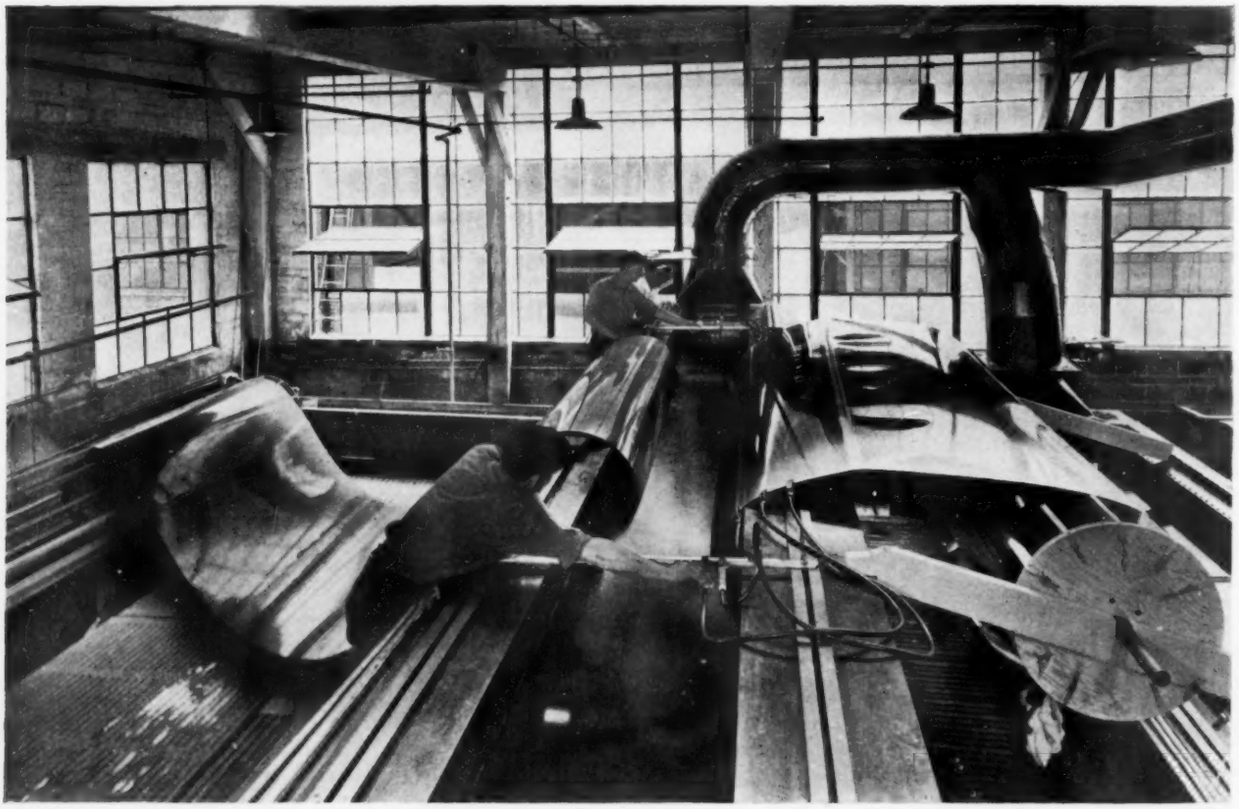
Six of these planes were delivered last year, and six more are under construction. The latter will not be ready, however, until 1941. So huge are these boats that you cannot appreciate their size unless you are close to them. Seeing them at a distance doesn't impress you fully with their extraordinary dimensions.

Quoting the length of 106 ft., wing span of 152 ft. and height of 28 ft. doesn't do these giants justice. But it helps a little to tell about the passageway through the wing by which mechanics move freely from engine to engine (each plane has four engines), and to point out that each of the four-engine nacelles which house the main powerplants has room for two mechanics to work in flight.

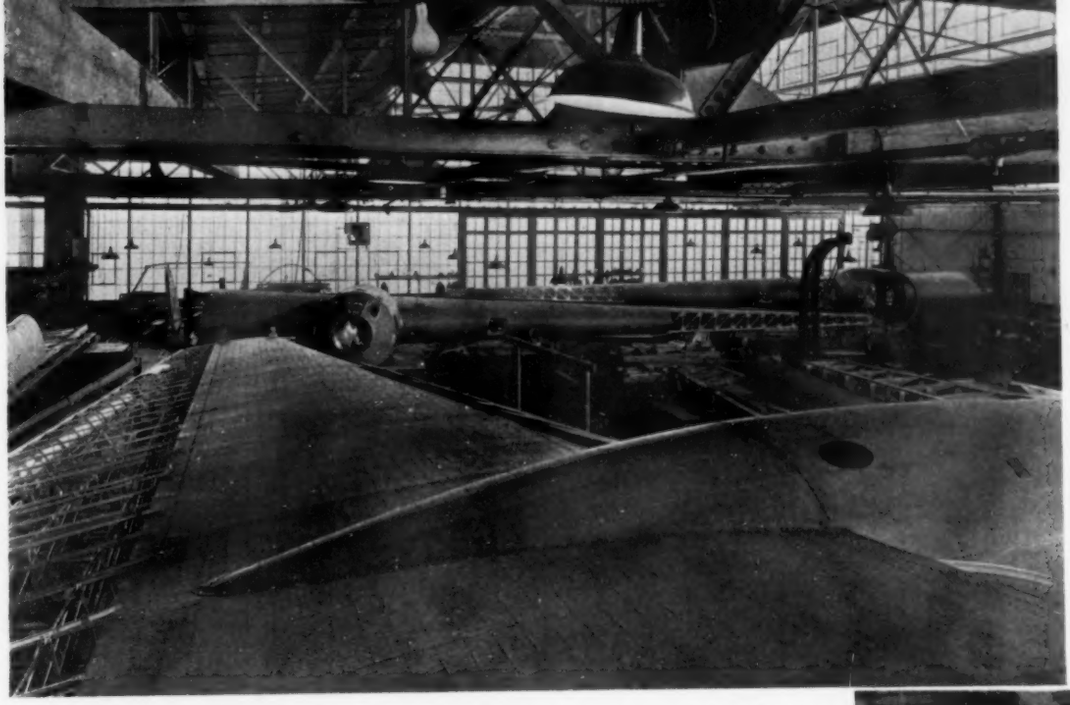
Each flying boat contains a galley where stewards serve meals for crew and passengers, a spiral staircase from the passenger deck up to the bridge, and a dining lounge which seats fourteen people. These features illustrate the big machine-work job required in building such a massive flying structure.

Tooling is the first job in the man-

Wing panel coverings are assembled into a single sheet by means of a spot welder. A traveling reel accumulates the sheet as it grows while rolling it past the electrodes



The aluminum alloy wing section skin is anodized by a continuous process developed in the Boeing shops. Large sheets of material can be handled in a single operation with economy and improved surface finish



A vast expanse of metal sheeting is fabricated into one piece before being attached to the wing structure. The after portion of the wing will be covered with fabric

ufacture of any plane: in this case it is a major operation. Great steel parts have to be machined from solid stock to serve for some of the special erecting jigs on which the hull and wings are assembled.

Flame Cutting Found Useful

Much of this jig steel, and some of the steel for other parts, is first cut to rough shape on a pantograph gas torch-cutting machine. Not all of the large machining operations are performed on such heavy chunks of metal as those which pass under the pantograph torch. Many involve bulky but relatively light units such as the engine mounts, where the work itself is large, but machine dimensions must be held to close limits. These vital units are first assembled by welding steel tubular members together in a rigid steel assembly jig. The engine bearers are accurately faced in a special fixture after the mount structure is completed. It is then sand-blasted and cadmium plated for the application of protective finish.

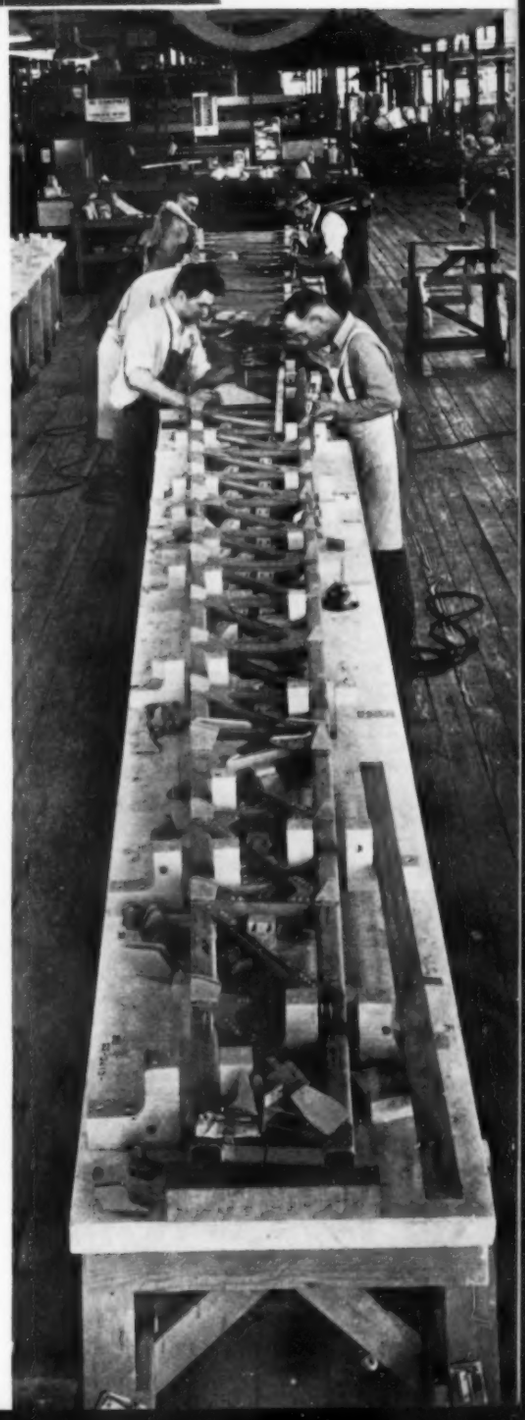
Many large fittings and parts are processed from steel forgings and aluminum alloys in forged, cast or extruded shapes. These require bulky machine set-ups, but despite their size a high degree of accuracy must be maintained.

An interesting development is the fabricating and processing of large sheets of aluminum alloy in a single operation. Stock sizes of Alclad sheet alloy are electrically spot welded into a single large sheet that will cover the metal-covered portion of an entire wing panel in one piece. (The wing is built in three parts—a center section and two outer panels. Only the forward portion of each outer wing panel is metal covered, the part back of the main spars being covered with fabric.)

Such a sheet of metal, ready for attachment to the wing, measures 7½ by 54 ft. Obviously there are some problems connected with handling this large and flexible piece of material, especially in view of the precautions that must be taken against scratching the Alclad.

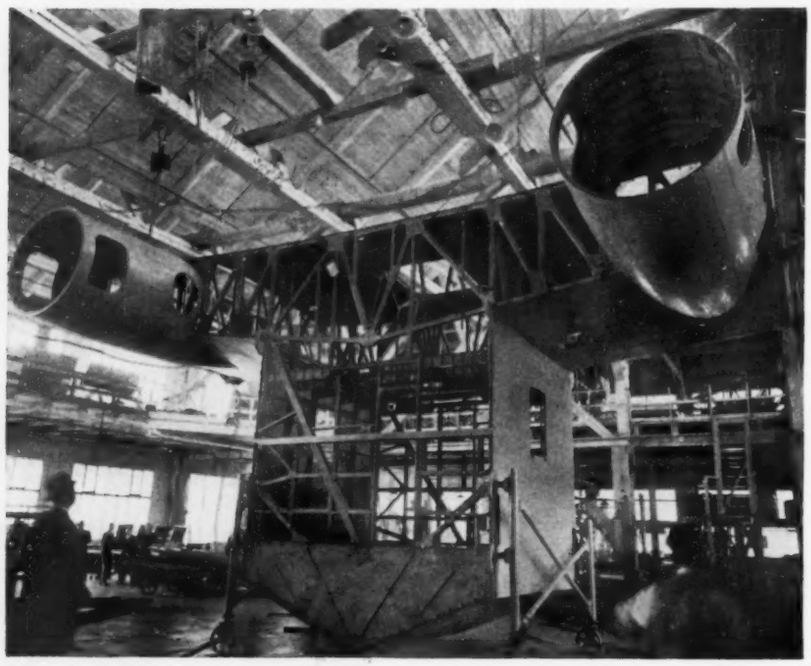
First the spot welding is done on a deep-throat Federal spot welder with the help of a special work jig that rolls the sheet up as it grows. The roll and weld work table, supported as a single unit on small rollers, glide back and forth under the jaws of the welder to speed the forming of the multiple-weld joint at each point of sheet attachment.

Because of the salt-water service to which the plane is subjected, this metal must be protected in every way from corrosive action. The entire sheet, after fabrication on the spot welder, is anodized in the first continuous-flow anodizing system developed by the aircraft industry. In the anodizing shop, the sheet material is moved from one wooden roll to an-



A great variety of special fittings and formed tubes are jig assembled. This main wing spar jig gives full accessibility for hand and tool work

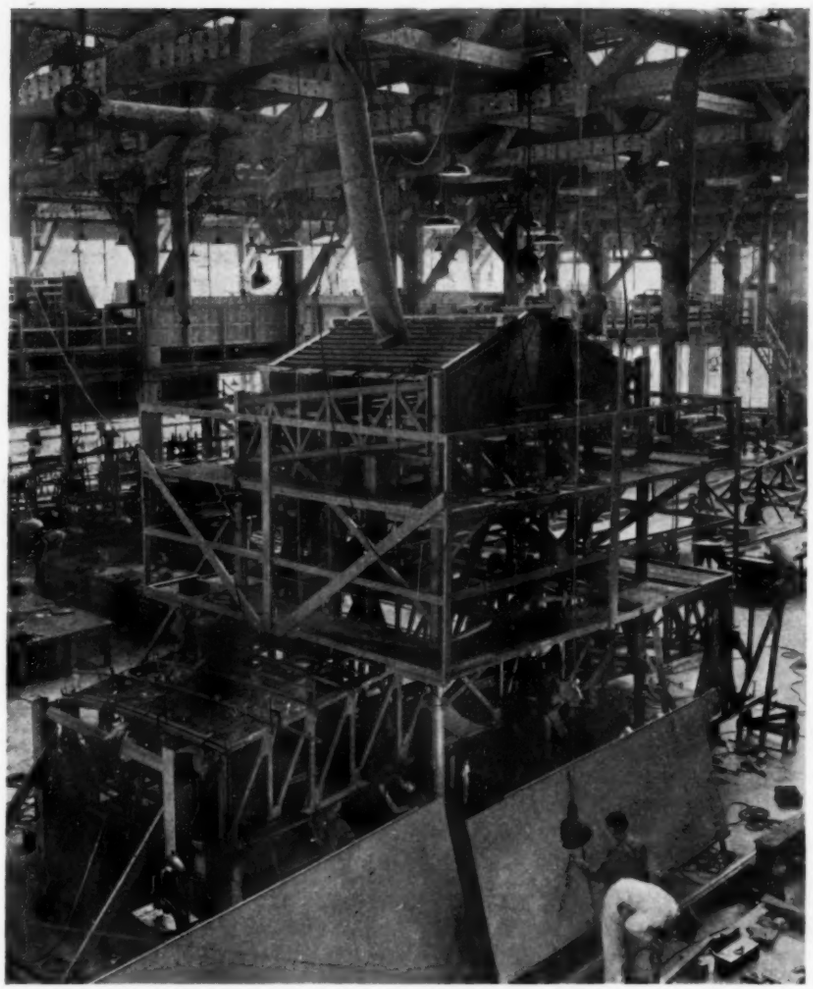
An ingenious traveling crane jig was developed by Boeing technicians to speed the assembly of large traverse frames for the hull



After completion, the hull center section is removed from its jig, turned upright and moved to the master jig for assembly with the hull structure

other, meanwhile passing down through an anodizing solution and a suitable electric circuit, which produces the oxidized surface so desirable as an undercoating for the protective coat of paint that is later applied. The entire sheet of metal is then primed, unrolled along the wing structure and riveted to it.

Another significant development involves the travelling crane universal drill jig machine developed for the assembly of major hull frames. A number of large assemblies must be fabricated into single pieces measuring as much as 19 by 34 ft. before they can be set up in the assembly jig for incorporation in the plane's structure. This work is done through laying out the main frames on flat plate jigs equipped with suitable form blocks. Spanning this jig layout is a large, low crane stretching above the work on parallel supporting tracks. Suspended in turn on this crane, by suitable tracks, guides and rollers, is an electrically driven drill which can be used for drilling all holes and also



The hull center section is assembled in a huge steel jig of rigid construction. This work is done with the section inverted for convenience of the workers

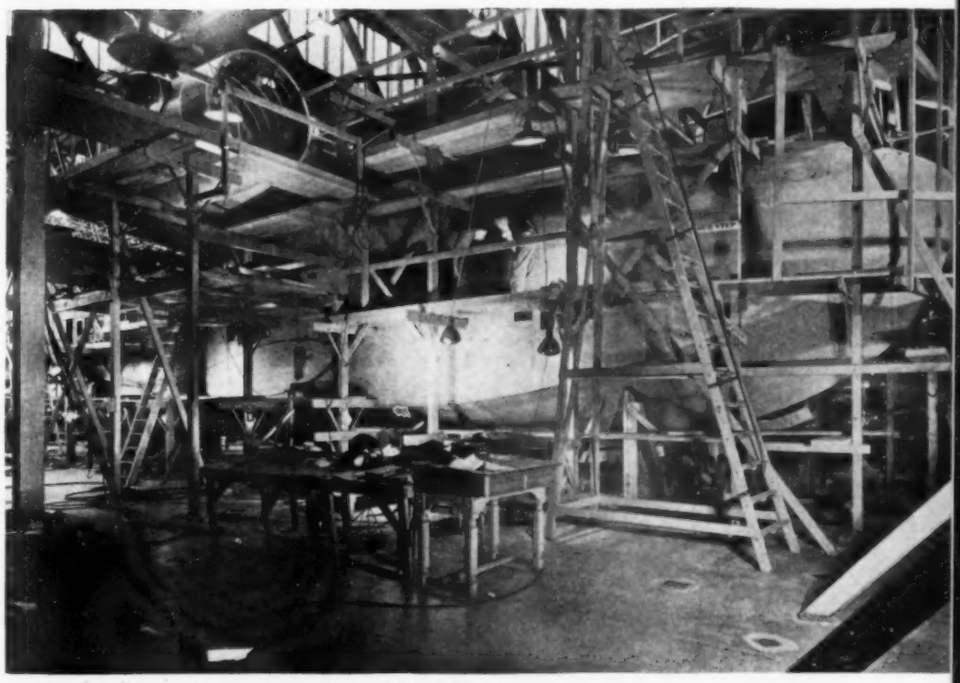
for driving nuts and studs. Through use of this equipment, the assembly of unwieldly frames is quickly performed with a high degree of accuracy.

Similar tactics are used in laying out the main wing spars, which attain a maximum depth of about 4 ft. and a length of 59 ft. These spars are assembled on special jig tables, permitting full accessibility for power equipment to drill, rivet, or bolt.

Interesting enough, the hull assembly operation is not performed in a single jig, as in the case of a boat. The hull center section, which also incorporates the center section of the wing and the two inboard engine nacelles, is considered the backbone of the entire ship. It is assembled in a separate steel jig of rigid structure and constantly checked for dimensions. For ease of assembly work this jig is mounted so that the hull section is built in inverted position, with the wing near the floor and the belly of the hull pointed towards the ceiling. Upon completion, this unit is removed from its jig, turned over and moved into the main hull jig, where the nose and tail sections are assembled to the center section.

Even after removal of the plane from the master jig there is a tremendous amount of work to be done before launching. Workmen swarm through the hull and wing completing a thousand and one details of installing equipment, accessories, plumbing and wiring. In this work they are aided by the size of the plane, which permits men to move without restriction anywhere within the hull, and throughout the major part of the interior of the wing. Most of this work is done after the plane has been moved out into the open as there is not sufficient room in the factory to attach the wing, engines and propellers.

Sometime, within approximately twelve months, another fleet of Boeing over-ocean transports will thunder off the waters of Puget Sound and speed to join the earlier Boeings that now fly Pan-American's Atlantic and Pacific routes.



The forward end of the hull is trussed up in a web of scaffolding which allows craftsmen to work at five different levels simultaneously

Clean House

GOOD HOUSEKEEPING is one of the few duties that the shop supervisor and the housewife have in common. As the appearance of a home reflects the character of its occupants, so the cleanliness of a shop indicates the quality of its output. A disorderly plant breeds carelessness and invariably turns out sloppy work.

From the sweeper to the plant manager, cleanliness must be a habit—a state of mind. Every man in the shop must play his part in the clean-up job. The results will be real: a better product, more efficient operation, and improved working conditions.

Here are some of the boys doing their bit toward a more orderly shop.

Herb Hoyst, the crane follower, sees that castings are kept within the white lines that mark the shop aisles. He knows that a covered line will lead to further encroachments and soon the shop trucks will have no room to move

Bill Barrow places refuse containers where they will do the most good. He's noticed that the men will put paper lunch boxes, fruit skins and other rubbish in them if they're handy. What's more, he empties them regularly

Tim Turner finds he can do better work on a clean machine. He keeps the oil reservoirs filled and the ways free of chips and dirt. He won't allow an accumulation of junk to lie around his lathe

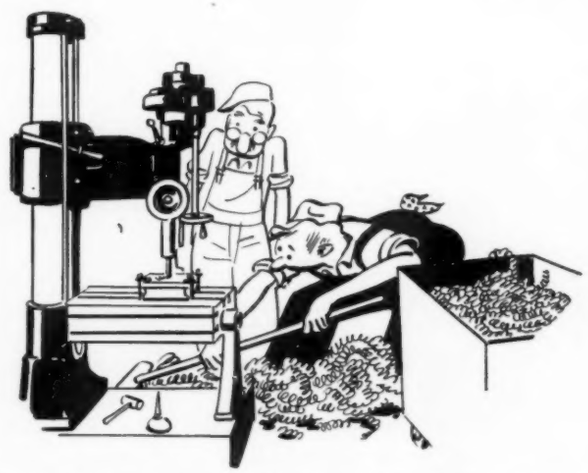
Buddy Broome is a sweeper with a conscience. He doesn't sweep the rubbish under a pile of castings but piles it into a tote box and takes it outside. The corners don't escape his eagle eye either

Bertram Binns takes care of the stockroom, and he's fussy as an old maid about it. Every part has it's place and is kept there. Anyone throwing a piece of scrap into the bins has a scrap on his hands with Bert

Phil McPayne is the window cleaner; his job is to let in sunshine. It's not drudgery because he's found that a bright shop is a cheerful shop. And what better job than to brighten the working hours of his shopmates?

Steve Skidmore removes trucks and tote boxes when the operating departments have finished loading or unloading them. He piles them up neatly, out of the way, where they can be found without cluttering the shop

Benny Banister knows that stuff left on stairways is a prime cause of accidents. He keeps the stairs clean and paints the corners of the stairwells white. Benny has his ups and downs but is always there when needed



Charlie Cutting removes the chips from the machines. He doesn't wait until the pans get full and the chips begin to spread around the floor. He cleans up once a day, every day. Finds it easier, too

Mike O'Toole doesnt' leave broken tools and cutters lying around. If they're in good shape, they go back on the rack. If they're damaged they go to the toolmakers for repair or resharpening

Preventing press-work troubles

BY **WALTER KASSEBOHM,** SUPT. TOOL DIVISION, MARCHANT CALCULATING MACHINE COMPANY

Despite long runs, stampings for office machines require precise duplication. Proper selection and operation of dies mean low-cost production and trouble-free assembly

SUCCESSFUL PRODUCTION of interchangeable parts for office-calculating machines depends largely upon correct selection, precise set-up and skillful operation of punches and dies. These are generally mounted in die sets for long production runs, although they may be made either as small unmounted units or as separate units for use in standard holders, as shown in Fig. 1. Each class has distinct features which must be considered during set-up and operation if maximum production and minimum maintenance costs are to be attained.

Where dies are clamped to bolsters, the clamps should be set as shown at the right in Fig. 2. The incorrect use of clamps, shown at the left, would set up side thrust *A* which tends to throw the die out of alignment. The general positioning of the clamps depends on individual jobs.

For satisfactory operation it is imperative that the die holder should have an opening of the correct size. Fig. 3 shows a faulty set-up in which the opening *A* in the bolster is much too large for the opening *B* in the shoe. That will result in bending the die shoe and there is danger of misaligning strains and possible breakage.

The die should always be tightened in the punch holder first, so as to align the die shoe correctly. The punch holder should first be tightened in the ram by the clamp. The die shoe should then be aligned with the punch holder and clamped to the bolster. Only in cases where the die sets do not have punch-holder shanks can this rule be disregarded, since in such cases the punch holder is held to the ram by screws that fit into slots large enough to permit correct alignment of punch holder and die shoe.

Punches and dies that perform blanking and piercing operations should be set to such a shut height that the punches will not enter the die more than from 0.002 to 0.005 in. Any deeper setting endangers both members and will require a much deeper grinding of both punches and die block in case they are sheared by incorrect operation.

A class *C* die, consisting of independent punch and die set in standard holders must be set-up in the

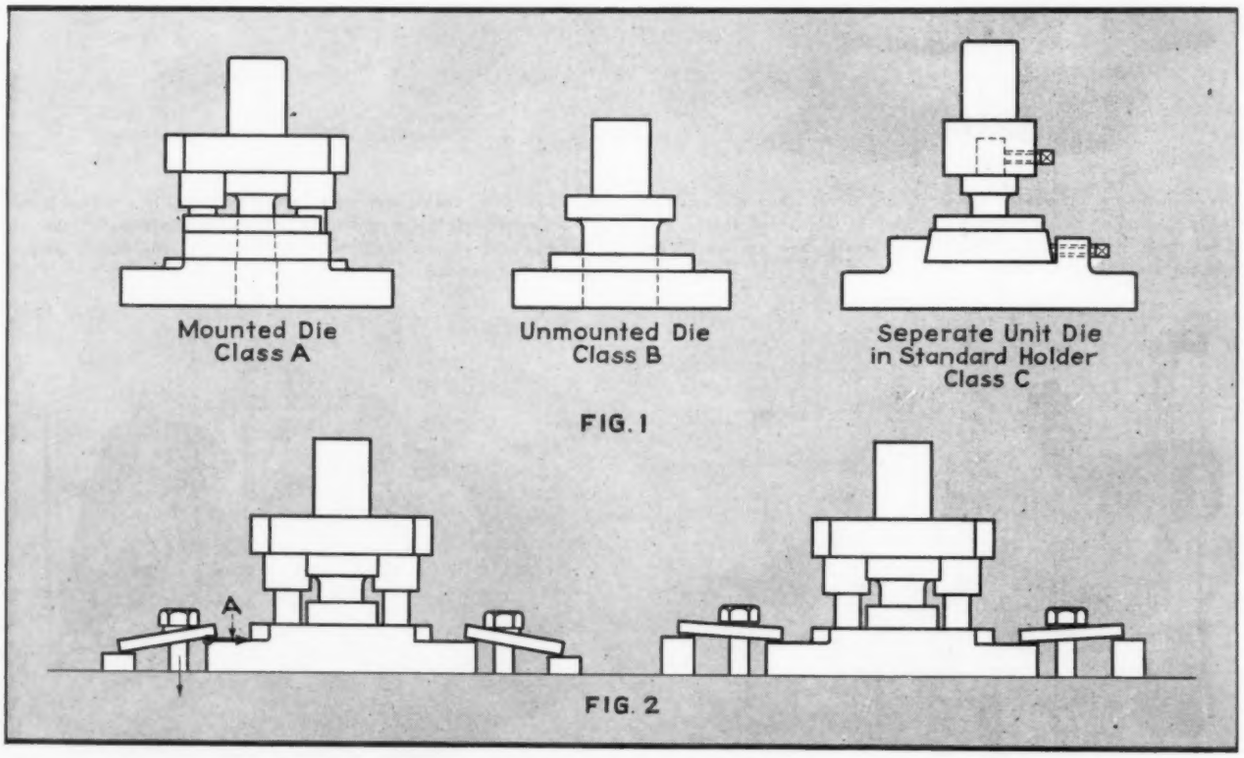


Fig. 1—These classes of press tools have distinct features which must be considered in their set-up and operation if maximum production and minimum maintenance costs are to be attained. Fig. 2—When dies are clamped to bolsters, the clamping screw should be nearer to the bolster than to the clamp heel; clamps should be held horizontal or have their outside ends slightly above the clamped surface

press in such a way that the clearance between the punch and the die opening is equally distributed all around the contour.

Should the punch be set one sided in the die opening so as to have all the clearance space on one-half of the blank and none on the other, the blank produced will most likely have an excessive burr. The punch will be working under a constant side strain which may lead to scored or damaged cutting corners or possible breakage.

Loose Gibs Are Bad

For the successful operation of punches and dies it is of great importance that the gibs of the ram be tightly adjusted. Otherwise, if the center of gravity of the blank opening in the die or of the combined blanking and piercing openings do not correspond with the center of the ram, a tilting moment will be set up, resulting in a misalignment of the punch. In Fig. 4 is shown the center of the ram at *A*, and at *B* the center of gravity of the blanking opening. The force required to blank the part times the distance *C* is the moment which in connection with loose ram gibs has caused many manufacturing troubles.

The actual operation of punches and dies depends, of course, upon their specific design, and to expect faultless operation year in and year out when thousands and millions of parts must be produced, is a Utopian dream. But there are a number of items that will help to reduce the cost of die repair and maintenance to the minimum if observed by the operator.

Leader pins on die sets should be sufficiently oiled at specific intervals to prevent scoring or freezing.

If parts are ejected from the die by compressed air, the blast should throw them clear of the die so as to prevent them from bouncing back into the die with the possibility of damaging it.

Stocks or parts should have correct lubrication to prevent wear on punches and dies.

The first blank produced in plain blanking dies should always be a full one to prevent side strains on the punch by partial cutting. Strip stock can be correctly placed on the die to assure a full blank by sighting through the stripper.

In running strip stock through progressive blanking and piercing dies, it is detrimental to have the stock run through its entire length. A partial piercing of holes by small punches at the end of the strip stock is a great hazard to both die and punches. In Fig. 5 is shown a piece of scrap. The last holes pierced should have been the ones at *A*, and not the half holes

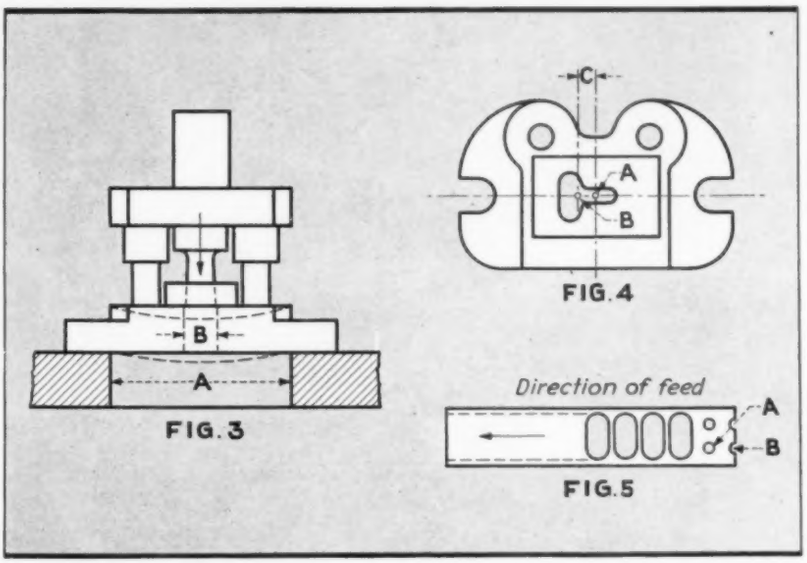


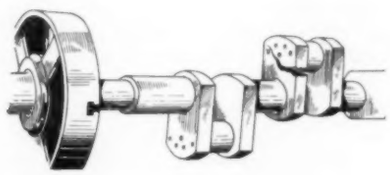
Fig. 3—Here is a faulty set-up in which the die opening in the bolster is much too large compared with the die opening in the shoe. Heavy work will bend the die. Fig. 4—Ram gibs should be kept tight, especially where the center of the die opening does not coincide with the center of the ram. A tilting moment combined with loose gibs has caused many manufacturing troubles. Fig. 5—The half holes in this piece of scrap were caused by the operator wanting to get one more piece from the stock. Punch misalignment, burred holes, sheared punches and die openings, and excessive wear result

B. But yielding to the temptation to run off one additional step and make one more blank produced the partial holes at *B*, the cutting of which causes misalignment of small punches, produces holes having excessive burrs, shears the punches and the openings in the die, and causes excessive wear.

Progressive dies with either automatic stops or plain stop pins generally have pilots of some kind that locate the strip stock in the correct position to produce blanks having holes in accurate relation to the contour of the blank. The press operator must at all times move the stock positively against the stop. Otherwise the pilots will have to do too much work in moving the stock into position, involving distortion of the pierced holes in the parts of the next strip stock or breakage of the pilots themselves.

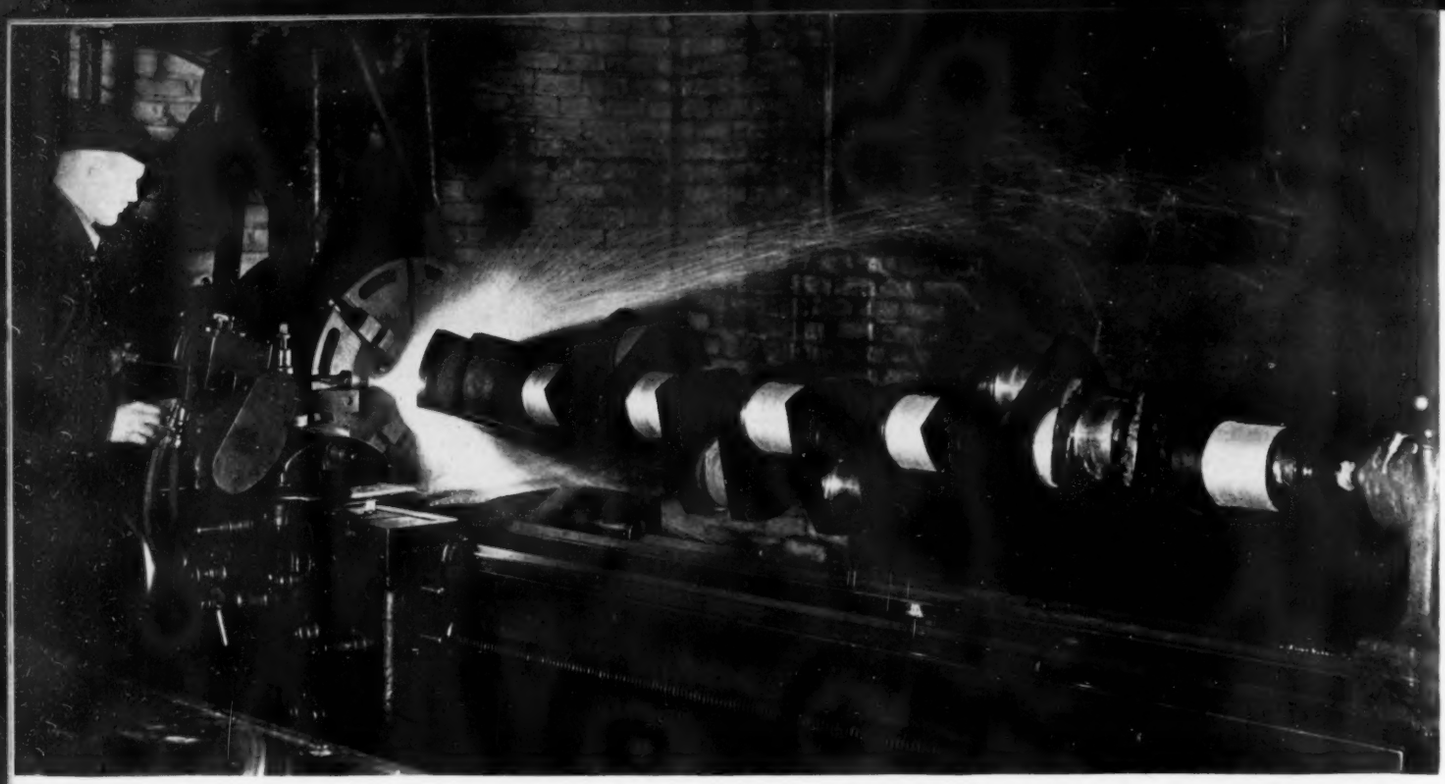
Tough Welding Job

SKEPTICS as to the reliability of welding should be convinced by the job recently found in a small job shop on the Jacksonville dock. The crankshaft of a diesel marine motor had failed in the third web from one end. The size and importance of the job can be judged from the 5-in. shaft diameter.



Holding the short part in the chuck the other part was lowered into position. It is shown just before it was lined up by several steady rests. This was not the first job of the kind so the shop knew exactly what to do. Before welding, the metal surrounding the break is burned away with the torch. When all the affected metal is removed the welding begins.

From 15 to 20 lb. of metal was used on the shaft of a similar engine and this shaft has been in daily service over a year. In fact the repaired crankshaft drove the boat that towed the disabled motor over a hundred miles to have this repair made.



High-carbon steel sprayed on main and crank bearings, and finished by wet grinding, has added 200,000 service miles to the life of these diesel-engine crankshafts. This work is done by the Precision Engineering Company

New parts for old

BY **P. LEDER,** METALSPRAY COMPANY

Metal spray restores machine parts worn in service. What's more it often makes them better than the originals

RESTORATION of machine elements by metal spraying has opened a wide field for the machinist in repair shops handling almost every type of machinery. It not only enables him to restore expensive items at a fraction of their original cost, but in many cases extends the utility of the item by applying a metal superior to the base metal of which the element was originally made. Machine parts may be coated with metals basically unrelated to each other; for example, bronzes can be sprayed on steel, or stainless steel on carbon steel or cast iron. Thus, a machine element can be restored with metal equal to its present properties, or if advisable, with metal which will give greater resistance to wear or corrosion.

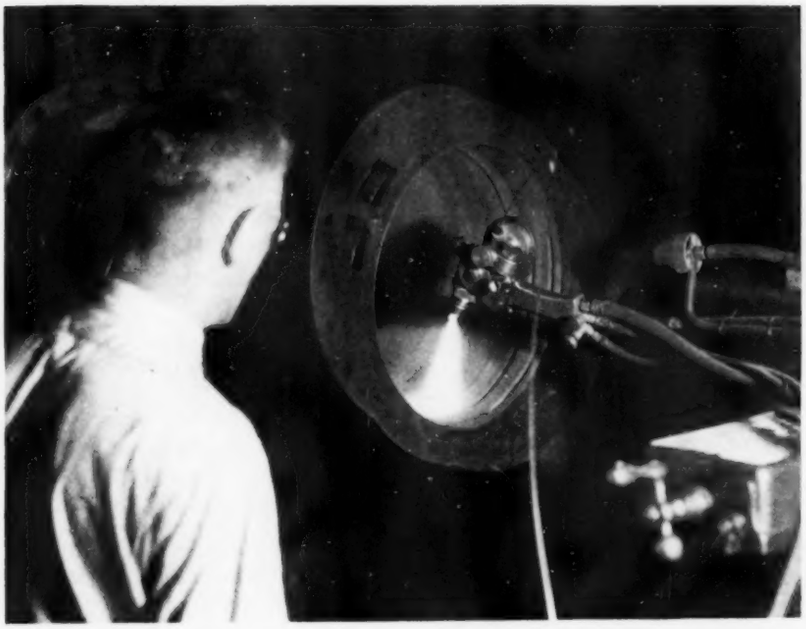
The Precision Engineering Company, has for a number of years been reconditioning diesel-engine crankshafts by this method. High-carbon steel is sprayed on all main and crank bearings which are afterwards finished by wet grinding. Preparatory to metal spraying and finishing, the journals are machined with 24 rough broken threads per inch using a slightly round-nosed V-shaped tool. The cutting edge of the tool is ground in such a manner as to "plow off" the metal, resulting in a multiplicity of locking surfaces for receiving the sprayed molten metal. The metal-spraying tool used in this instance is an electrically driven gun having a capacity of 14 lb. of sprayed molten steel per hour. High-carbon steel was sprayed on the throws and bearings to a diameter about 0.020 in. larger than their original size to allow for finish grinding.

Practically all of the reconditioned crankshafts give better service than the originals, because the molten metal air-hardens upon being deposited and the surface characteristic of the sprayed metal is such as to retain the lubrication better than the original metal surface. One crankshaft remained in serviceable condition for more than 200,000 miles.

This company has established the total cost of metal spraying a crankshaft as less than half the cost of a new one. Additional savings result through the use of the original bearings, which are fitted to the increased diameter of the crankshaft journals.

Many repair shops have for a number of years been salvaging large numbers of pistons for power engines and compressors. Rough threads are turned on the surfaces, which has proved to be the most satisfactory method of preparing a bonding surface for the sprayed metal. The piston, chucked in a lathe, is revolved as the metal is sprayed from a gun held in the tool post and advanced along the lathe bed at standard lead-screw feeds. Both low- and high-carbon steel is used for rebuilding the surfaces. Most of the better shops use high-carbon steel and finish the piston by wet grinding, thus obtaining a hard high-quality finish frequently better than that on the original piston. Shops not equipped with grinding equipment, rebuild these pistons with low-carbon steel and finish them by turning in a lathe.

Spraying stainless steel on the cylinder walls of oil meters is not an uncommon job. These have cast-iron cylinders which become useless after a short period of service because of corrosion from acid or alkaline con-

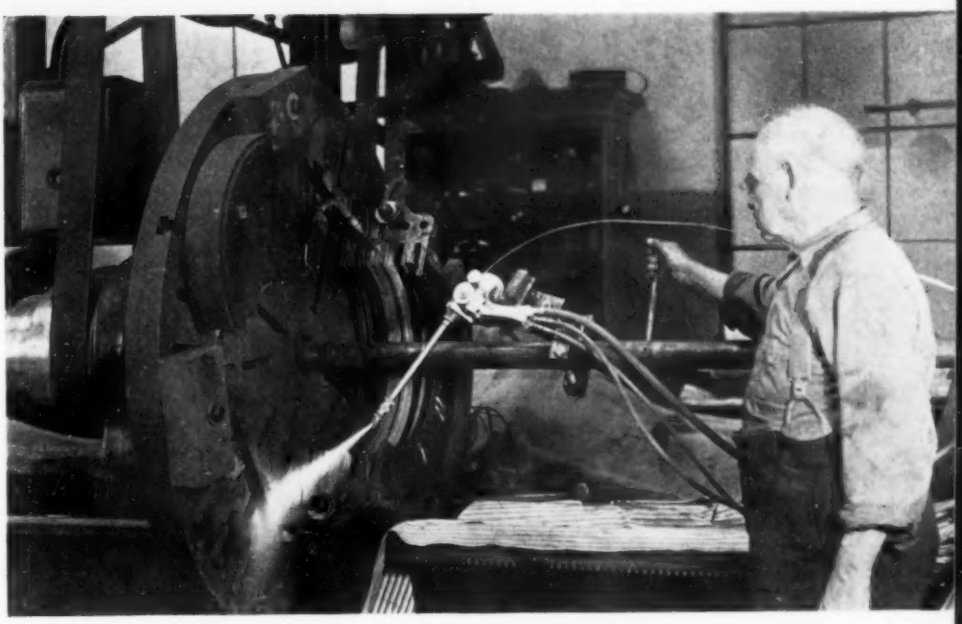


Cast-iron cylinders of oil meters are sprayed with 18-8 stainless steel to eliminate corrosion from acid or alkaline content of various crude oils. The cylinder is bored undersize and then rough cut with 20 threads per inch preparatory to spraying the 18-8 stainless steel

tent in crude oils. A replacement made of the same material would be of no more value than the original; therefore, on the strength of satisfactory results obtained on similar meters sprayed with stainless steel and working under similar conditions for several years without a trace of corrosion, these cylinders are coated with $\frac{1}{16}$ in. of 18-8 stainless steel in the following manner.

The inside diameter of the cylinder is bored out approximately $\frac{1}{8}$ in. oversize, and 20 rough threads per inch are machined to provide a bonding surface for the sprayed metal. The spray gun is equipped with an angle aircap to divert the sprayed metal about 30 deg. from its direct stream. As shown in one of the illustrations, the gun is mounted on a bar extending from the tool carriage of the lathe in a manner to assure face coverage of the full length of the cylinder surface. The gun, oscillated slightly by manually operating the cross-feed, is fed from one end of the cylinder to the other by the lead-screw feed until the desired inside dimensions are obtained, adding enough metal for finishing.

Wire of 12 B&S gage (0.081 in. diameter) is used and 32 lb. of 18-8 stainless steel were deposited in less than six hours. A suitable finish was obtained by lathe tooling. To reduce the possibility of overheating the cylinder, an air blast was placed directly behind the gun, thereby maintaining the temperature of the cylinder at 185 F., although room temperature varied from 65 to 86 F.



One-half of a 25,000-kw. steam turbine sealing ring channel is shown being rebuilt with 18-8 stainless steel. The other half of the channel was reconditioned two years previously with sprayed metal and was not honeycombed by the cutting action of water and air circulating with the runner, which necessitated the reconditioning of the sealing ring here shown

The Department of Water and Power of Pasadena, Calif., recently rebuilt the side walls of the sealing ring of a 25,000-kw. high-pressure steam turbine. The sealing ring channel had become badly honeycombed by the cutting action of water and air circulating with the runner. One-half of the runner had been reconditioned by metal spraying two years previously, and was in excellent condition when dismantled. The other half of the channel was rough cut with a round-nosed tool for retaining the sprayed metal by rotating the half casting in a lathe. A shaft was then fixed between the lathe centers and the spray gun was mounted thereon. The gun, equipped with an extension nozzle and angle aircap to enable the spray to reach the narrow dimension of the channel, was pivoted by moving the shaft forward and backward manually in a half circle. The nozzle covered the radius of the channel, applying the stainless steel with a minimum loss.

As 18-8 stainless is toolable with a lathe tool, the deposited metal was reduced to within 0.008 in. of the required finish size, and finished by wet grinding. The repair cost was less than 10 per cent of the replacement cost, and based on the service given by the previously reconditioned portion of the casing was expected to increase the life of the turbine by decreasing corrosion effects. The turbine has been in service for a sufficient period of time to justify these expectations.

Chucks and holding fixtures

BY J. R. LONGSTREET AND W. K. BAILEY, THE WARNER & SWASEY COMPANY

CHUCKS form the largest group of holding devices used on turret lathes. There are three general classes: (1) universal chucks, of the geared scroll, geared screw or box type where all jaws move together; (2) independent chucks, where each jaw is operated separately; and (3) combination chucks, where each jaw may be operated independently but where all jaws can be moved as a group, as with the universal chuck. In addition, there are power-operated universal and combination chucks.

The two-jaw universal box chuck is used for holding small work of irregular shape. The jaw screw, which is operated from either end of the chuck, gives rapid movement to the jaws because of its coarse pitch, and moves both jaws at the same time. Jaws are made to fit the work and are attached to master jaws by dovetails, cross-keys or other adapters.

The three-jaw universal geared scroll chuck is used more often than any other type for turret lathe applications. With standard jaw equipment it holds work of regular shape, when fitted with special jaws irregularly shaped parts are held easily. For turret lathe application these chucks should be of the heavy-duty steel body type with removable and reversible top jaws.

Used for holding parts of irregular shape when quantities are small and the cost of special jaws for universal chucks would be prohibitive, the independent chuck finds application for work that must be trued up. It also is used for heavy-duty work where the gripping surface is short and the work is long in relation to its diameter. This chuck grips the work tighter than a corresponding geared scroll chuck. It is, however, slower to operate.

On combination chucks, master jaws are of two-piece construction with an independent jaw screw between the sections. The bottom part of the jaw is moved by the scroll, and the top part is moved by the independent jaw screw. Top jaws ordinarily are of the removable and reversible type so that they can be used for external or internal gripping, and so that they can be replaced with special jaws. Combination chucks are furnished with either three or four jaws. They are used when holding irregular shaped pieces, or when a jaw needs to be offset from a true circle.

While hand-operated chucks have the disadvantage of slow operation and heavy physical effort by the operator, they have distinct advantages in their low cost, the ease with which they are put on machines, flexibility because of the different types of chucks obtainable, and the different types of jaw adjustment. With these chucks the gripping pressure can be controlled between roughing and finishing cuts, thereby reducing distortion and promoting accuracy.

Chucks operated by air cylinders, hydraulic cylinders or electric motors through the spindle of the machine are all of the same type. This type of chuck is quick acting and requires no effort on the part of the operator beyond the moving of the valve handle or switch control. Total jaw movement varies from $\frac{3}{4}$ to $1\frac{1}{4}$ in. on the diameter, depending upon whether the chuck is of the three-jaw or the two-jaw type. The limited jaw mo-

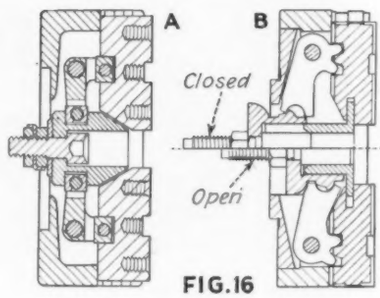


FIG.16

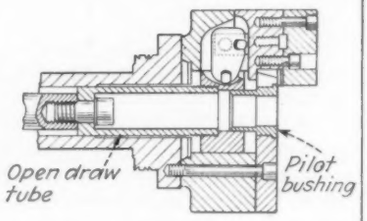


FIG.17

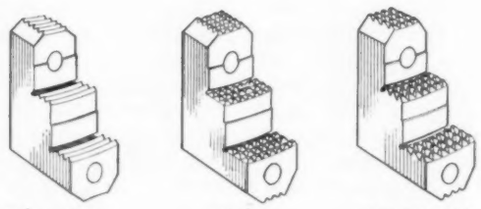


FIG.18

Fig. 16—Air or hydraulic chucks used under low pressure to avoid distortion of work require locking devices in jaw linkage to overcome effect of centrifugal force. Fig. 17—When piloted boring bars are used the draw tube of a power-operated chuck should be as shown. Fig. 18—To be effective, corrugations on chuck jaws must be sharp enough so that the points will embed themselves in the work

From a forthcoming book on turret lathe tooling.

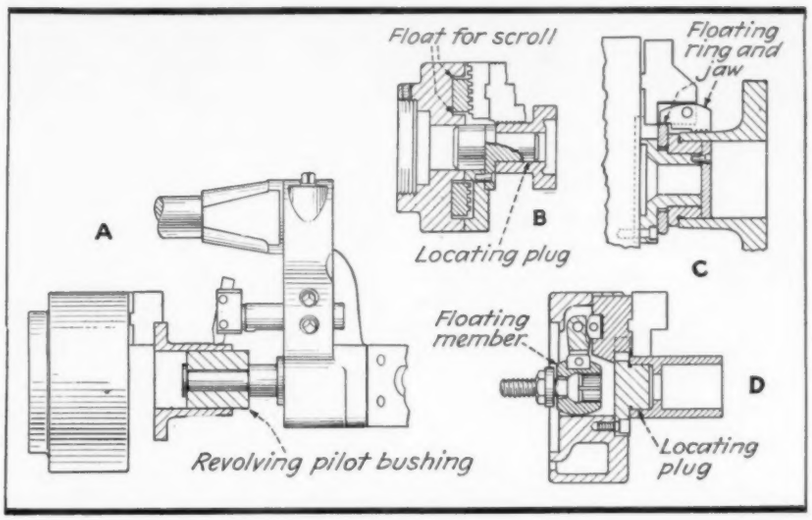


Fig. 19—The three methods illustrated make possible closer concentricity than do soft chuck jaws on second operation work

tion makes it impossible to reach over a large diameter to get at a chucking surface, but the entire range of jaw movement can be utilized for gripping, instead of a limited portion, as in the case of the wrenchless chuck.

These power-operated chucks are suitable for rapid handling of light and medium work, and for holding heavy work when the chucking effort is great. Air and hydraulic chucks have the advantage of constant application of power while the cut is in progress. Electric units use a reducing gear and a screw of a self-locking type to operate the pull rod.

When low pressure is applied, in order to avoid distortion of the work, these chucks must provide locking devices to overcome the effect of centrifugal force which acts against the pressure in the operating cylinder and may cause the jaws to open. The diagram at *A* in Fig. 16 shows ordinary jaw linkage, while at *B* is shown a chuck with a locking device in combination with the linkage to prevent the centrifugal force from opening the jaws.

Power-operated chucks are operated through the spindle of the machine and, as a result, the spindle is not available for work to pass through it, unless hollow cylinders and drawrods are used. When piloted boring bars are used, the construction of the draw tube should be similar to that shown in Fig. 17.

Chuck Jaw Mountings

Most chucks are furnished with base or bottom jaws—sometimes called master jaws—to which top jaws are fastened. The bottom jaws fit the body of the chuck and are moved in or out by the scroll on universal chucks, and by the screw on independent chucks.

Standard hardened jaws, Fig. 18, are used for a wide variety of work. The steps on the jaw provide for a range in diameter, and the jaws can be used for internal or external gripping. When the shoulder on the jaws cannot be used for locating the work endwise, adjustable backstops mounted on the face of the chuck, or wire ring backstops, may be used. On short runs, backstops often eliminate the need for making special jaws.

Special Jaws for Better Grip

Special hardened jaws may be used to obtain a better grip on the work, or to hold irregular shapes. In addition to the corrugations, the gripping surfaces may be furnished with replaceable hardened drive pins. It sometimes is practical to cover the gripping surfaces with Stellite and grind corrugations in the Stellite. On special jaws the endwise locating point or backstop usually is built into the jaw. When mounted on power-operated chucks the locating shoulder should be wider than the amount of jaw travel.

The standard soft jaw commonly is used for second operation work when gripping on finished diameters. Soft jaws are fastened to the base jaw in the same manner as the hardened jaw, but the gripping power depends upon a broad surface instead of upon corrugations. The jaws are bored or turned in place on the chuck so that they will accurately fit the finished surface on which they are to grip. If accuracy between the gripping surface and the surfaces to be machined is necessary, soft jaws must be "trued up" each time they are put on the chuck. When boring or turning the jaws, they should be clamped on a disk or ring with the same pressure that will be used when holding the work. Also, the chuck pinion used to tighten the disk should be marked so that this same pinion can be used each time a piece is chucked. Following this procedure, second chucking work can be held to a concentricity of 0.002 in. runs of 25 to 100 pieces.

Precise Second Operations

When the concentricity of surfaces machined in the second operation with the previously machined surfaces must be closer than 0.002 in., the plain soft chuck jaws will not be sufficiently accurate. Three methods illustrated in Fig. 19 will make possible closer concentricity. At *A* is shown a combination of soft jaws and revolving pilot. The piece is held in accurately bored soft jaws and the turning head is guided in the work by a pilot which closely fits the previously machined bore of the work.

The work can be located on an accurately centered plug mounted on the face of the chuck, as shown at *B* in Fig. 19, and the jaws grip on the outside diameter to act as drivers only. Locating diameter of the scroll inside the chuck has been enlarged so that the scroll has about $\frac{1}{16}$ in. float in the body of the chuck. This allows the jaws to shift or float as they are

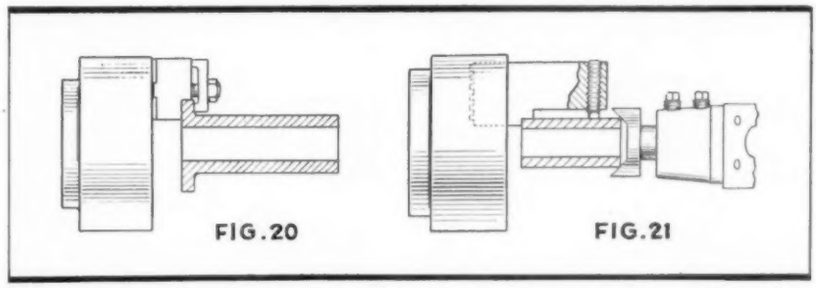


Fig. 20—Holding clamps used with standard chuck jaws provide effective holding on long work when the work permits. Fig. 21—Setscrew type long jaws provide a good method of holding long work

brought against the work, so that the three jaws can grip truely on uneven surfaces while the work itself is located by the plug in the center hole.

At *C* is shown how the same effect of floating jaws can be obtained without altering the chuck itself. An accurately centered hardened plug is mounted on the chuck and the work is located on this plug. The gripping surface on each jaw is part of a rocking member, the front end of which grips the work and the rear end bears on a floating ring. A floating jaw setup for a power-operated chuck is shown at *D* in Fig. 19. In this case the floating or compensating member is inside the chuck.

grip the work firmly without distorting. The jaws for this class of work use either broad gripping surfaces which reduce the pressures at any one point, or are designed so that the work is pinched across a solid section. In the latter case the chuck is used to operate the jaws for centering or locating the work, while the driving is obtained by pinching or clamping through solid sections. The broad gripping surfaces on the jaws shown in Fig. 22 will hold frail work without distortion. These jaws provide six contact areas, two on each jaw and all three jaws are of the rocking type. Rocking points *A* are broad.

The jaws shown at *A* in Fig. 23

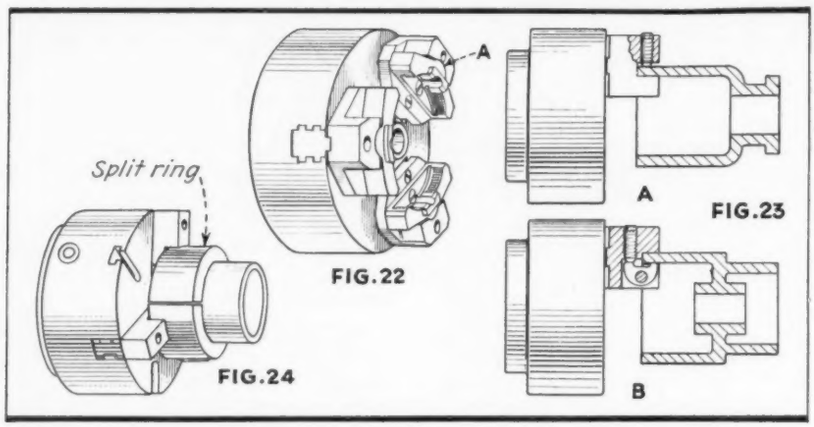


Fig. 22—Broad surfaced rocking jaws will hold frail work without distortion. These jaws provide six contact areas on the work. Fig. 23—Pinch jaws frequently are used for frail work. The jaws are tightened only enough to hold the work in place, then the set-screws are tightened. Fig. 24—The split ring method of holding frail work distributes pressure evenly over the entire surface of the work

The four-jaw chuck provides an excellent low-cost method for holding long work, providing the pieces are strong enough to withstand heavy jaw pressure without distortion. Full gripping pressure can be applied to each jaw separately. When the work permits, holding clamps used in addition to standard chuck jaws provide a very effective method for holding long work. If there is no flange on the work, shallow holes may be drilled and the ends of the clamps fitted into these holes. Jaws with holding clamps are shown in Fig. 20.

The setscrew type of jaw shown in Fig. 21 is inexpensive but provides an excellent method of holding long work. The combined grip of the jaw near the chuck and the set screws near the outer end of the piece will hold the work rigidly against the strains of heavy cuts.

When machining frail work, the problem is to provide jaws which will

are machined to accurately fit the bore of the piece, and the jaws are tightened only enough to hold the work in place. The setscrews in the jaws are then tightened to pinch the work against the gripping surface of the jaw, thus obtaining a firm hold on the work without distorting its shape. At *B* the same pinch idea is used, but the jaws are arranged to locate the work on an outside diameter. Both of these illustrations show how a standard chuck may be used as a second operation fixture. If the gripping surfaces have been machined previously, soft jaws may be bored or turned and the jaws left in one position, the work being slipped into them and gripped by means of clamps or setscrews.

On small quantity work where extra-capacity collet chucks are not available, the split ring method of holding frail work, Fig. 24, can be used. The work is placed in an accurately bored split ring, and then this ring, which has a heavy wall section, is held in soft jaws which have been bored accurately. When gripping the ring in the chuck, the jaws should be operated by the same pinion each time in order to assure accuracy. The same principle can be used for holding parts that are threaded on the outside.

Special Holding Fixtures

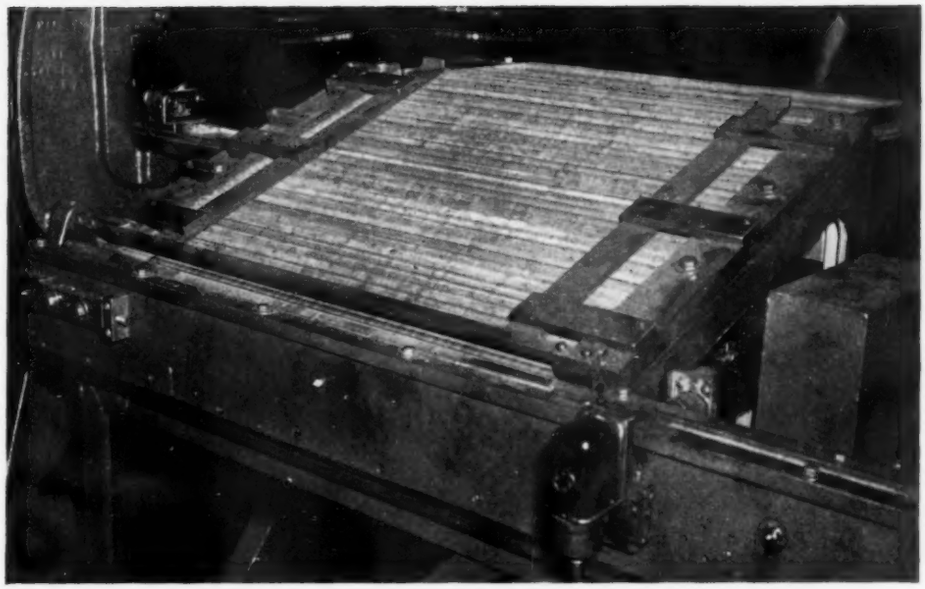
Special fixtures often are used instead of standard holding devices when the work is of irregular shape, when difficult jobs have to be rigidly held for accurate or heavy cuts, or when their use will save enough time to justify their cost. While the time saved by loading the work faster in special fixtures is important, it is not any more important than the time saved by taking heavy cuts when work is held properly.

Some fixtures are designed to be mounted on standard chucks and used in connection with chuck jaws; some fixtures require indexing; some fixtures hold work before it has been machined; and others are designed to accurately locate work on previously machined surfaces. Standard faceplates ordinarily are used to adapt fixtures to the spindle noses of turret lathes. Pot fixtures provide an excellent method of holding work securely so that heavy cuts can be taken. The work is gripped at both ends and solidly held so that it cannot shift in the fixture. This type of fixture is inexpensive and can be designed to hold several different sizes of work.

Angle-type fixtures are used when it is necessary to machine a diameter in exact relation to a previously machined flat surface. The parts are clamped against hardened and ground locating rails or plates. The location of the part may be accomplished by means of pins set in the locating plate and projecting into previously machined holes in the casting.

When parts have to be machined in two positions that are only a slight distance apart, swinging or sliding indexing fixtures can be used. These fixtures are less expensive than rotary indexing fixtures, but ordinarily cannot be run at as high speeds.

Weight saved in transportation vehicles adds an equal amount to the possible pay load, assuming of course equal strength and stability. Trucking men consider every pound saved as worth from 80 cents to a dollar in the cost of a truck.



The electric eye on the conveyor in the foreground operates the trip feed on this magazine for rocker-arm shafts, maintaining an uninterrupted stream of work to a centerless grinder

No stoppage in this stock

Hopper feed insures a continuous supply of shafts to a centerless grinder in Buick's new use of the electric eye

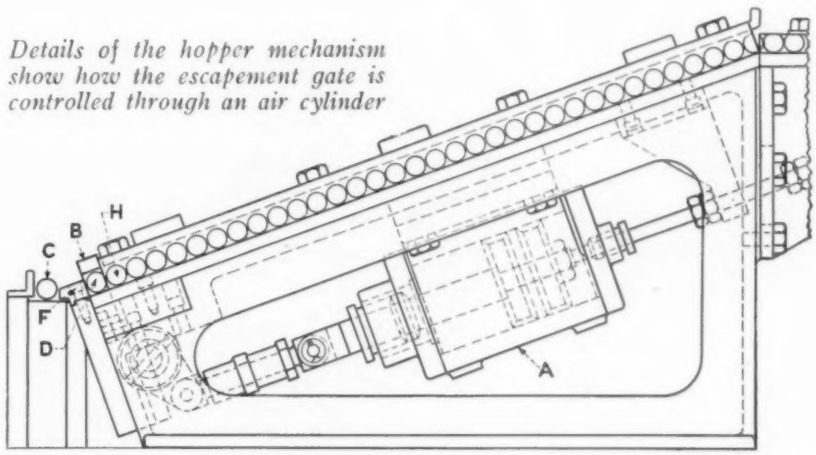
BUICK will centerless grind over 600,000 lineal feet of valve rocker-arm shafts during the 1940-model production season. These shafts, cut and straightened, are fed to the grinding machine by a chain conveyor moving slightly faster than the wheels are able to consume the work. Friction between the shafts and chain maintains the former in an endless stream, providing there is no interruption in placing the shafts on the chain as might be the case were it done manually. An empty chain would cut down production.

To obviate such an occurrence, the illustrated feed magazine was devised and equipped with a trip mechanism, operated by a photoelectric cell, or electric eye, which drops a shaft to the conveyor as soon as the preceding one clears the edge of the magazine. The electric-eye beam is broken as each shaft moves forward on the chain. The instant a shaft clears the beam, light hits the photocell and a circuit is energized, causing a solenoid to actuate air valves which operate a piston attached to the feed trip. Speed approaches snap action. The two illustrations on this page show the conveyor, hopper feed table, and details of the latter. The electric eye is on teh conveyor and adjacent to the hopper.

Reference to the drawing shows that the double-acting cylinder *A* actuates a linkage which raises and lowers gate *B* during one interruption of the beam. The mechanism is shown as it has come to rest after dropping piece *C* on the feed chain. Another piece *D* lies within the nest in the gate, the nest being obtained by slotting a rectangular bar. When gate *B* next rises it will lift piece *D* to the level of pad *F*. Gravity causes *D* to roll over the inclined surface *F* and down into the feed trough. Piece *H* cannot move until the gate drops, when it takes the place of piece *D*. The lower edge of the gate prevents a piece from getting under the gate and jamming the mechanism.

Development of this magazine feed has permitted grouping straightening presses on both sides of the feed table. Operators need only pass the finished work to the inclined table. Gravity and the electric eye do the rest.

Details of the hopper mechanism show how the escapement gate is controlled through an air cylinder



Microscope aids "mike"

BY **ROBERT C. GIBBONS**, MILWAUKEE PLANT, INTERNATIONAL HARVESTER COMPANY

Micrometer measurements in the machine shop depend in part upon the structure of the steel being worked. Here's what the metallurgist sees

FORTUNATE IS THE SHOP where the metallurgist and the machine shop foreman see eye to eye. Shop supervisors as a rule are fully able to take care of mechanical troubles; often their trouble is a contempt for laboratory findings. Most shop men are progressive enough to recognize that there are some things a cutting tool won't show; and this is doubly true for the alloy steels.

The metallurgist, on the other hand, may not understand machining practices. However, he should become sufficiently familiar with the shop to be able to select a good machining structure. He should also be able to recognize defective material and to identify causes of trouble due to the metal itself. Often he will be able to recommend changes in heat-treatment.

At the Milwaukee plant of the International Harvester Company several years of metallurgical investigation have been applied to common shop complaints. The more pertinent findings are recorded here. The conclusions have no reference to faulty shop practices and assume that tools and machine set-ups are satisfactory.

Once they are understood, the most common troubles are easy to identify under the microscope. Many can be detected without a microscope. In any event it is advisable to get complete information regarding the kind of steel, previous treatment, hardness and nature of the difficulty encountered, before coming to a decision.

One common type of trouble involves hard spots in the steel. Often they are not recognized but breaking or chipping of tools or short tool life indicate that hard spots may be present. Causes may be any of these:

SLAG. Slag is present in all steel to some extent and usually occurs in greatest amounts at the center. Fig. 1 shows slag at the center of a bar of S.A.E. 1025 steel. This was pickled in muriatic acid. The slag made it impossible to machine at this point. Fig. 2 shows slag as the dark area in S.A.E. 3120 steel forging, and was the cause of breaking of a tool.

Finer slag particles such as shown in Fig. 3 do not wreck the tool but if many are present may result in shorter tool life. In general, the smaller the size of the slag particles and more nearly round they are, the less trouble they give. Variation in analysis of slags makes some difference but no

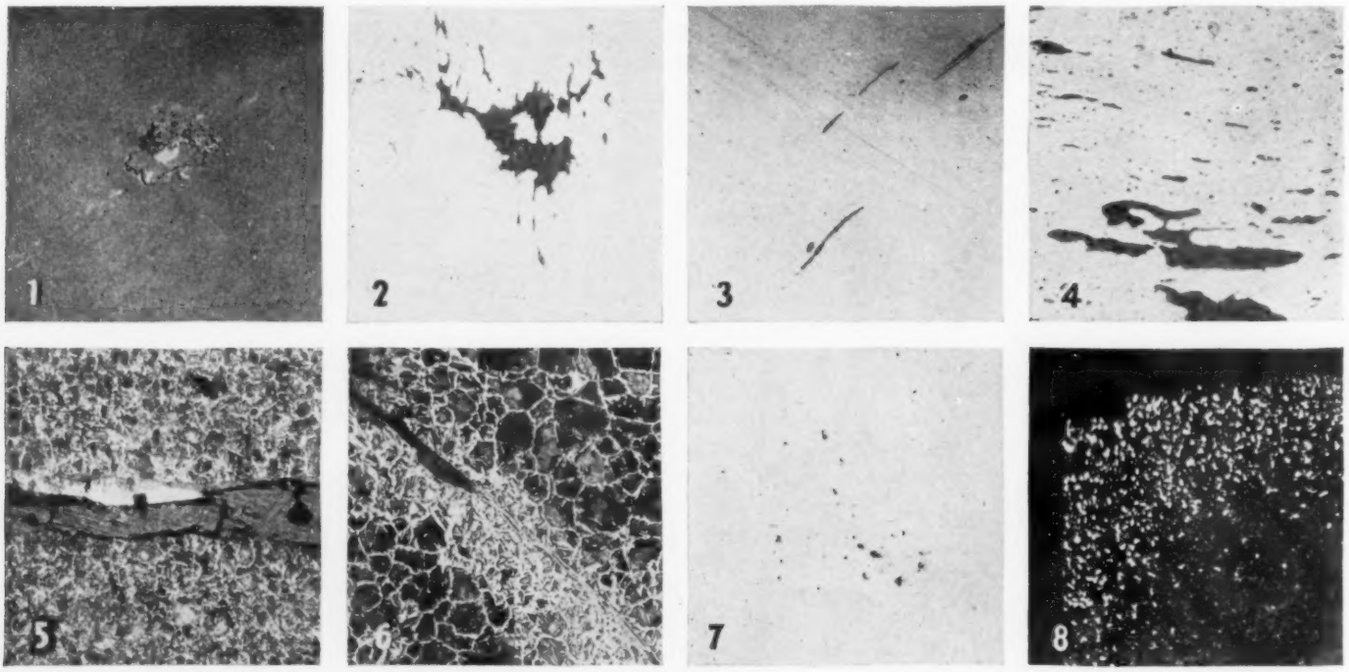


Fig. 1—Shows slag in the center of a bar of S.A.E. 1025 steel. Pickled in muriatic acid. Natural size. Fig. 2—Slag in S.A.E. 3120 steel forging. Not etched. Mag 100X. Fig. 3—Slag stringers in S.A.E. 1040 steel. Not etched. Mag. 100X. Fig. 4—Slag in wrought iron. Not etched. Mag. 100X. Fig. 5—Large slag stringer in S.A.E. Nital etch. Mag. 100X. Fig. 6—Forging lap in S.A.E. 1040 steel. Note scale surrounded by decarburizing area. Nital etch. Mag. 40X. Fig. 7—Aluminum oxide pits in S.A.E. 1040 steel gave poor tool life. Not etched. Mag. 100X. Fig. 8—Excess carbides in carburized S.A.E. 4620 steel resulted in poor tool life. Nital etch. Mag. 100X. Fig. 9—Carbide segregation in high carbon stainless steel caused trouble. Etched in

general rules are given here. Another fact worth mentioning is that the softer the steel the less effect slag has on tools. For example, wrought iron, Fig. 4, contains considerable slag but is not particularly hard to machine nor as hard on tools as might be expected from the structure.

A large slag stringer in S.A.E. 1045 steel plate that would cause trouble is shown in Fig. 5. Some slags are harder than others and some are more abrasive, but until the steel mills start straining the steel through a silk handkerchief we may always have slag. Little can be done about it except complain to the mills and demand better inspection.

SCALE. Scale is softer than slag but is somewhat abrasive. For this reason, most forgings are pickled or sandblasted before machining. But, occasionally rolling seams of forging laps may push scale below the surface where it is not easily removed and it may dull or even chip a cutting tool. Fig. 6 shows an example of scale in a forging lap in S.A.E. 1040 steel. Scale may be easily identified because the metal around it is decarburized, showing white on etching.

ALUMINA. Metallic aluminum is often added to steels in the final deoxidation and to control grain size, especially in automotive steels. The aluminum oxide formed does not all go into the slag but remains as small, hard, round particles in the steel. These have the same composition as the grains in aluminum oxide grinding wheels and where they exist in quantity have enough abrasive action to cause excessive tool wear. Fig. 7 shows the holes from which these alumina particles have come out in polishing. This was S.A.E. 1040 steel in which poor tool life was reported.

Considerable care should be used before reporting the trouble as alumina. Similar pits known as polishing pits will occur in soft steels without alumina present. One difference is that at high magnification polishing pits are generally triangular while alumina pits are round. Another way of verification is by chemical analysis. Alumina is most commonly found in the fine grain carburizing steels.

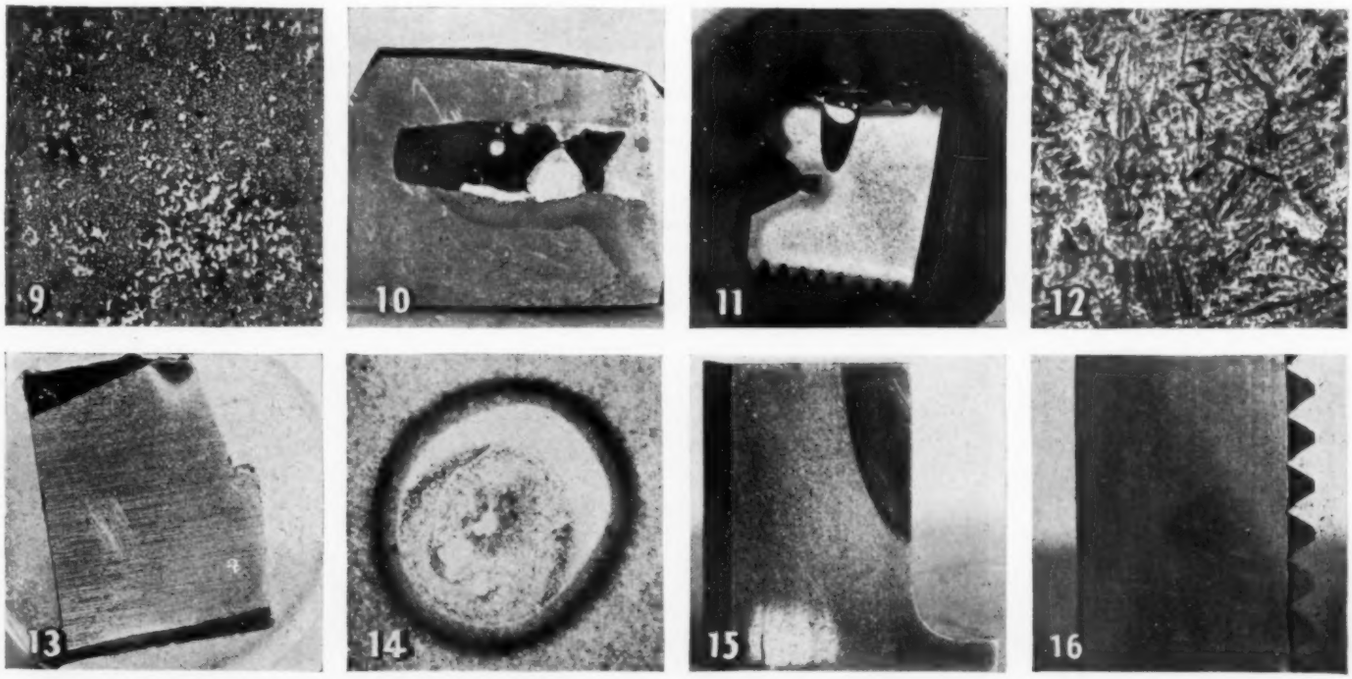
CARBIDE SEGREGATION. Iron carbide, Fe_3C, often called comentite, is very hard, and particles of any size may cause considerable trouble in machining. When present in a soft gray iron matrix the tools seldom chip or break but a relatively short tool life between grinds occurs. Cemented carbide tools are often used to minimize this. If the matrix is harder as in a carburized case, the extent of the trouble encountered depends largely on the size and amount. If few and small, not much trouble will be found, but if large and in quantity, poor tool life and even ruined tools may result. Fig. 8 shows carbide particles that gave poor tool life.

Segregations of these carbides may occur in high carbon steels of any type. Fig. 9 shows such a segregation in a high carbon stainless steel that caused machining troubles.

METALLIC SEGREGATION. This has seldom been found in large open hearth heats, but occasionally is seen in cast steel or smaller heats of Bessemer or electric furnace steel. It is best recognized as a nonuniformity of color in an etched and polished section.

CARBON SEGREGATION. A few cases have been found where bar steel has high carbon at the center of the bar which is hard. One S.A.E. 1025 steel had a small area in the center that analyzed 0.80 per cent carbon. Micro-examination shows such an area as much darker when etched, and it can be easily seen without a microscope.

WELDED SECTIONS. The comparatively rapid cooling of welded spot in salvaged or assembled parts gives a localized hardening effect. In low carbon steels no particular trouble results, but in higher carbon steels, above 0.25 per cent the spots may be



aqua regia. Mag. 100X. Fig. 10—Hard area caused when salvaging an S.A.E. 3140 steel shaft by welding. Nital etch. Mag. 7X. Fig. 11—Another example of salvaging by welding which left a hard spot in carburized S.A.E. 3120 steel. Nital etch. Mag. 2X. Fig. 12—Hardened structure of S.A.E. 3140 steel forging, quenched in water. Nital etch. Mag. 500X. Fig. 13—Upper right hand corner shows hardened spot formed by an electric arc. S.A.E. 3120 steel. Nital etch. Mag. 2X. Fig. 14—Surface view of arc spot in carburized S.A.E. 5120 steel. Nital etch. Mag. 70X. Fig. 15—S.A.E. 1050 steel hardened by Tocco process. Dark area is hard. Nital etch. Mag. 2X. Fig. 16—Upper right shows hardened area of S.A.E. 4340 Nital etch. Mag. 2X.

hard. Annealing treatments are recommended to overcome this. Fig. 10 and 11 shows cross sections of such spots in parts salvaged by welding that resulted in ruined cutting tools.

HARDENED PARTS. If the part is completely hardened it is easy to recognize by a hardness test. The micro-structure also is different. Fig. 12 shows the structure of a very hard forging made of S.A.E. 3140 steel and is identified as the martensite structure formed by quenching. The reason should be sought in such cases. In this case the forging was cooled rapidly by quenching in water to make inspection measurements, then tossed into the bucket with the slowly cooled forgings.

LOCALLY HARDENED SECTIONS. These are easily noticed by a variation in appearance of the etched section and are further identified by micro-examination. Actual causes may vary, including the following: arc spots are caused when a welding arc is accidently touched at the wrong spot or when an electric connection is poor and produces an arc. Fig. 13 shows such a spot at the top of the sample. This broke a tool. The actual cause of the arc is not known.

Fig. 14 shows the surface appearance of an arc spot in carburized S.A.E. 5120 steel occuring when the steel was magnafluxed. No harm was done in this case as it happened in final inspection, but where parts are magnafluxed before machining, hard spots may cause trouble.

SURFACE HARDENING TREATMENTS. Inductive hardening processes harden the surface only and only at certain points. Fig. 15 shows the hardened area as dark in a cross section of S.A.E. 1050 steel.

A peculiar instance is shown in Fig. 16. A shaft made of S.A.E. 4340 steel was to have the threads hobbed after hardening and tempering. But the steel was rather hard and it was annealed in molten lead to soften it. It did not soften. The micro-examination of this sample showed that the air cooling of this alloy steel had re-hardened the upper right hand corner harder than at first, the temperature of the lead having been at 1,500 F. Care must be taken to cool alloy steel slowly when annealing it.

OVERHEATING BY GRINDING. Although difficult to believe, it is nevertheless true that grinding can heat steel to above its critical temperature and on cooling it may harden. This has sometimes been the cause of hard corners on carburized parts that are ground and machined before hardening. Spots may become file hard and wreck cutting tools.

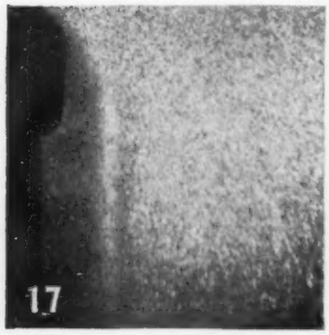
SELECTIVE CARBURIZING. On such parts as cam shafts where some parts must be carburized and hardened and other parts left soft, two methods of procedure are used. One is to protect certain parts from carburizing by means of fire clay or special paint. The other is to leave stock to be machined off after carburizing but before hardening. In either case something may go wrong, either the protecting coating doesn't protect or not enough stock is left, and the carburized case is present where it should-not be. This is easy to detect without a microscope by etching a cross section. Fig. 17 shows carburized case extending too far down on the sample with the result that the groove, which was to be cut after hardening, could not be cut.

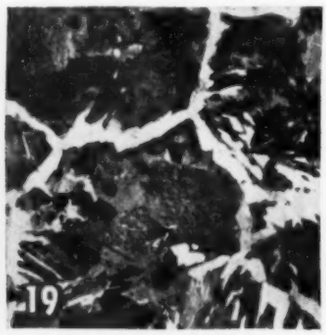
It should be noted at this point that while most carburizing steels as S.A.E. 1015 and 3115 do not become too hard to machine when the part is quenched, it is possible when the carbon content is 0.20 per cent or more as in S.A.E. 3120, 4620 or the new 4120 (not an S.A.E. steel yet), that the core hardness may run as high as 38-44 Rockwell C which is pretty hard to machine.

WORK HARDENED. Many alloy steels work harden rapidly if dull tools or poor lubrication is used and may result in hard spots. Fig. 18 shows such a spot in S.A.E. 3120 steel, the section at the right having been glazed to a very hard surface. This was traced to faulty lubrication.

CHILL IN CASTINGS. Many castings have one or more sections that are chilled rapidly giving a very hard structure. In cast iron these are difficult to eliminate except by a prolonged anneal.

Machine set-ups, especially on automatic machines are made for a certain type steel with certain hardness and structure, and any appreciable change in the steel causes varying results and sometimes trouble. Thus, if the machine is set for cold-rolled steel and a bar of hot-rolled steel is mixed into the lot, the change is definitely noticeable. And, if normalized forgings are being machined, one that is not normalized may cause trouble. It is always advisable, when such a change in machining occurs, to make chemical analysis and micro-examination of both types. Fig. 19 shows the forged structure of S.A.E. 3120 steel and Figs. 20, 21, and 22 shows normalized structure. The difference in hardness is about 40 points Brinell; 200 for the forging and 160 for the normalized metal, but the difference in finish, is noticeable. Either machines fairly well with the right set-up but the normalized structure is preferred. It has been found advisable to normalize forgings.





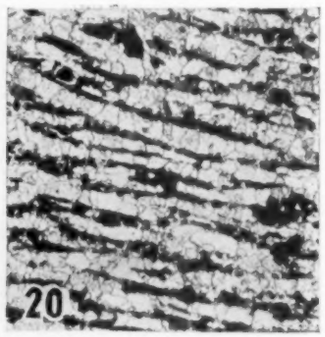


Fig. 17—Carburized case at right side caused trouble in cutting groove. Nital etch. Mag. 5X. Fig. 18—S.A.E. 3120 steel, hardened to Rockwell "C" 28, showing work hardened section at right. Nital etch. Mag. 5X. Fig. 19—Forged S.A.E. 3120 steel, air cooled, Light area is ferrite gray area is sorbite or pearlite, black area is relatively hard troostite. Nital etch. Mag. 100X. Fig. 20—Banded structure in normalized S.A.E. 4620 steel. Nital etch. Mag. 100X. Fig. 21—Coarse banding in 4620 steel forging. Light area is soft, gummy ferrite, dark area is pearlite. Nital etch. Mag. 100X. Fig. 22—Good normalized structure in 4620 steel. Nital etch. Mag. 100X. Fig. 23—Spherodized structure in S.A.E. 4130 steel is hard to machine. Nital etch. Mag. 500X.

TROOSTITE AREAS. In Fig. 19 the white areas are known as ferrite while the gray areas are called sorbite and pearlite, depending on the grain size. The very dark areas are classed as troostite. These troostite areas are comparatively hard but in low carbon steel little trouble is encountered. When found in steels such as S.A.E. 3140 they often result in short tool life. An annealing treatment remedies this.

BANDED STRUCTURES. All steels have a tendency to develop banded structures but the alloy steels are the most susceptible. Two types of banding are shown in Fig. 20 and 21, while Fig. 22 shows the same steel almost free from banding. The structure shown in Fig. 22 machines almost perfectly, that in Fig. 20 machines well but the one in Fig. 21 tears and gives a very poor finish. The dark areas are medium hard and cut nicely but the light ferrite areas are soft and gummy and tear rather than cut. Banding can be greatly reduced in low carbon steels by a normalize treatment that reaches a maximum of about 1,700 F. and a fairly rapid air cool through the critical range (1,500-1,300 F.). (Proper rate of cooling after normalizing of alloy steels resulting in Brinell hardness of 159-173 has been found to give good machining properties—Ed. Note).

SPHERODIZED STRUCTURE. Sorbite, being harder than pearlite, is naturally somewhat harder to machine, but there is another structure that has the same hardness as pearlite that is sometimes bad. This is called "spherodite" and is shown in Fig. 23 in S.A.E. 4130 steel. This was difficult to machine. Another bar of the same steel but with different heat treatment had the structure shown in Fig. 24 and this lamellar pearlite and ferrite structure machined very well. Both had the same hardness, 196 Brinell. However, with S.A.E. 4145 steel the opposite is true, the spherodite structure machining better than the lamellar pearlite.

The general rule appears to be that low carbon steels, 0.45 per cent carbon or under, when the hardness is below about 200 Brinell, machine best in the pearlitic structure; while steels 0.50 per cent carbon or over (slightly lower in alloy steels), with hardness running to around 250 Brinell, machine best in the spherodized condition.

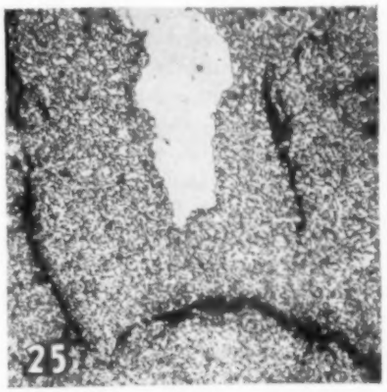
The pearlitic structure is obtained by annealing above the critical range, while the spherodized structure develops when the steel is held for some time at the lower edge of the critical range, about 1350 F. Fig. 25 shows spherodite in alloy gray iron after annealing which was difficult to machine. Fig. 26 shows the easily machined structure when the annealing temperature was raised to 1550 F.

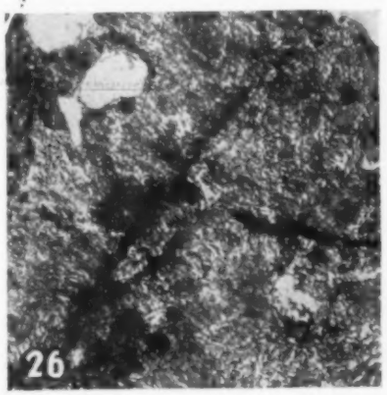
SOFT STEEL. A surprising number of complaints of poor finish and even poor tool life have been due to the steel being too soft, from 137 to 159 Brinell. Such steel has a tendency to tear rather than cut and often builds up on the tool causing rapid failure. Changes in machining practices often help but the structure may be hardened by normalizing, cooling more rapidly than usual.

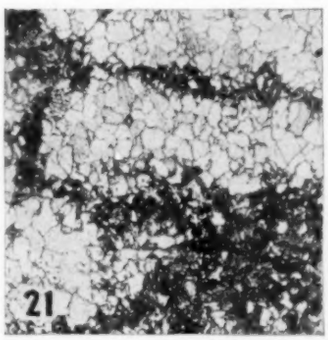
WRONG STEEL. The mild complaint that "the steel doesn't seem to machine right," is always given careful consideration. Usually nothing is wrong with the machining set-up but sometimes the wrong steel is being used. Mixed steel from the mill, or bars mixed in storage may result in considerable scrap if not caught soon and many such mixups have been noticed first by an alert operator.

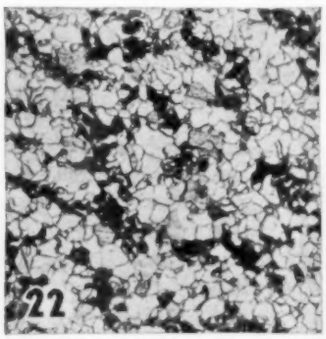
The troubles here listed have to do with only defects or peculiarities of the steel being machined. Defective tools or faulty machining practices are not considered. In about 25 per cent of the cases examined, no defect in the material was found and the trouble either "disappeared" or was corrected by changing the set-up, tools or lubricant.

All complaints on machining difficulties should be immediately investigated. Cooperation between machine operators, foremen, and metallurgical department will cut many dollars off machining costs and decrease the sale of aspirin.









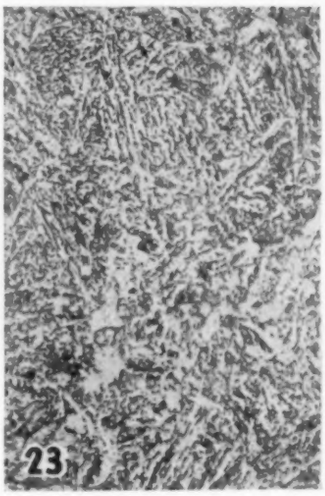


Fig. 24—Pearlite and ferrite in S.A.E. 4130 steel. Easy to machine. Nital etch. Mag. 500X. Fig. 25—Spherodized structure obtained by annealing alloy gray cast iron to lower critical range. Difficult to machine. Nital etch. Mag. 500X. Fig. 26—Reannealed at higher temperature gray iron shown in Fig. 25 machines easily. Nital etch. Mag. 500X.

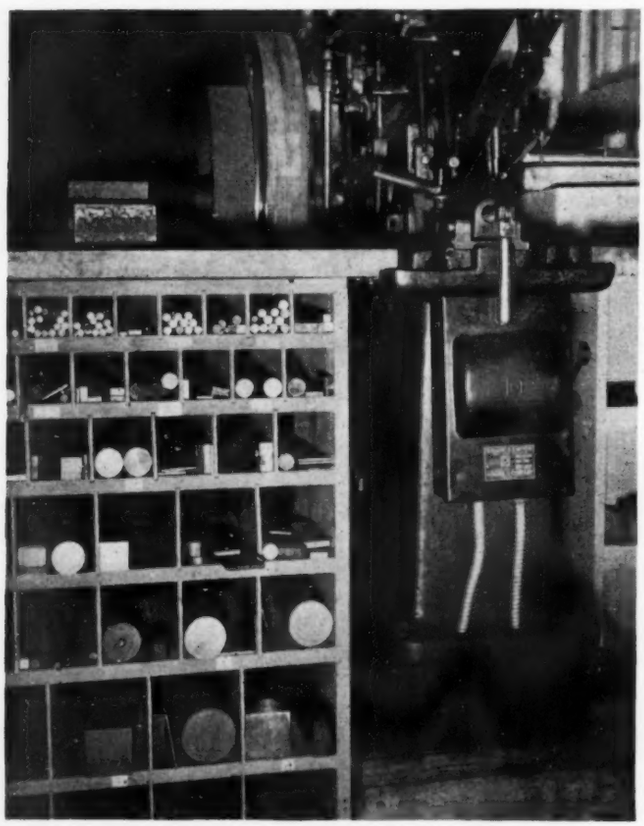
IDEAS FROM PRACTICAL MEN

Every Piece of Scrap Is Kept In Sight

By HENRY C. FRANCIS

Knowing where to find odds and ends of bar stock adds greatly to the value of any "hell box" or a scrap pile. Too often can they be found only by a time wasting hunt, if at all. The machine shop of the Churchill Weavers, Berea, Ky., has a different method. The cut-off or power hacksaw, is set between two sets of bins and mounted high enough to bring the vise even with the tops of the bins. This makes the bin tops serve as tables which are very convenient in handling the bars to be cut.

Pieces cut off and not used are stored in the bins provided beside the hacksaw as seen. Every piece is in plain sight and no time is lost in pawing over a mess of pieces of the wrong size. The time saved pays for such an arrangement very quickly, while the satisfaction of being able to find stock quickly is an extra dividend on the investment. As shown, no trouble exists when selecting scrap ends of different size.



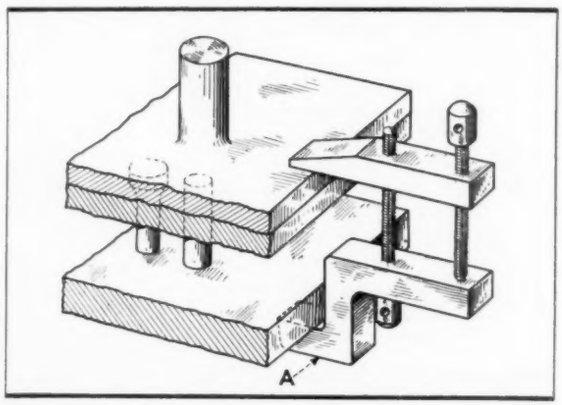
This scrap bin, set between power hacksaws, provides an easy means of locating odds and ends of bar stock. The bin top serves as a table

Offset Jaws Will Increase Range of Clamps

By PETER L. BUDWITZ

The capacity of the ordinary parallel clamp can be greatly increased by the application of the offset jaw shown at *A* in the accompanying sketch. It will prove to be an invaluable addition to the toolmaker's kit, since jobs often arise where more capacity is needed than is provided in the conventional parallel clamp.

After making the offset jaw it is necessary only to remove one of the regular jaws and attach it, as shown. One particular job in which two or more clamps provided with offset jaws are especially useful is clamping a punch assembly to a finished die-block for scribing the outlines on the punch blanks, a job for which the ordinary clamp has not enough capacity.

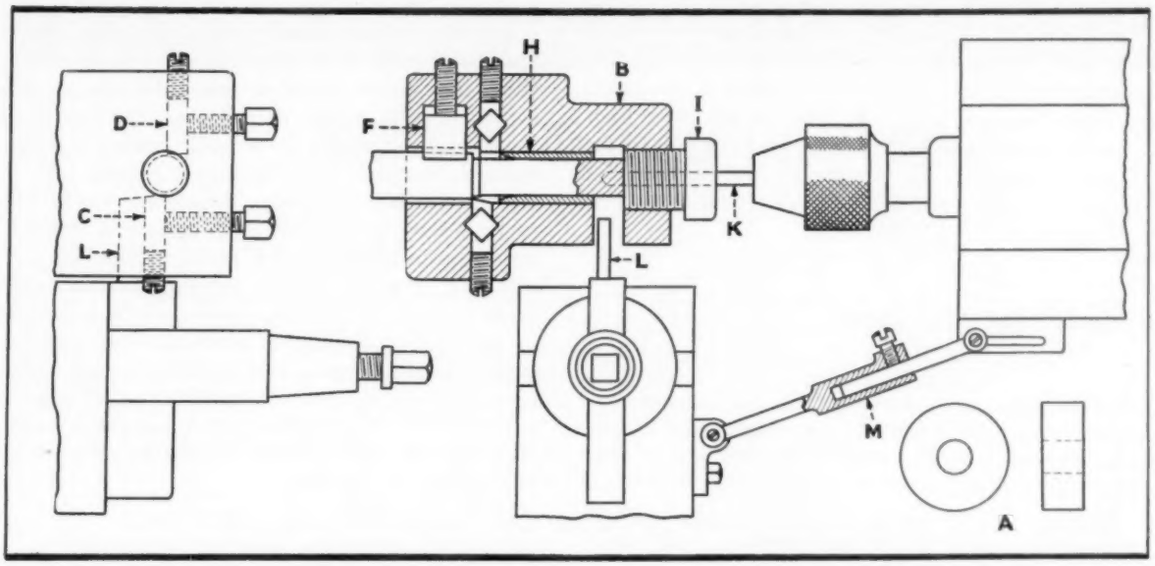


Many jobs that are beyond the capacity of the ordinary parallel clamp can be held if the clamp is provided with this offset jaw

Engine Lathe Equipped for Manufacturing

By GEORGE C. LAWRENCE

Having to make a large quantity of pieces such as the one shown enlarged at *A* and no screw machine being available, we rigged up an engine lathe as illustrated. The fixture *B* was clamped to the carriage and carried the roughing and finishing tools *C* and *D*; the backrest *F*; the guide bushing *H* for the stock; and the drill bushing *I* which also serves as a stop. The drill *K* was held in a drill chuck in the tailstock spindle and the cut-off tool *L* was held in the regular toolpost. The tailstock was unclamped and adjusted to slide freely on the ways and was connected to the cross-slide by the telescopic rod *M* which was pivoted to brackets in both the tail stock and cross-slide.



*In the absence of a screw machine, an engine lathe was rigged up as shown in order to produce the work rapidly and at minimum cost. Drill **K** is advanced automatically by rod **M** as cross-slide is withdrawn*

In operation, with all adjustments correctly made, the carriage is fed toward the headstock and the cutters reduce the stock to the required diameter. When the stock contacts the inner end of the drill bushing, the feed is stopped and the cross-slide is backed out, the action changing the angle of the telescopic rod and drawing the tailstock forward, causing the drill to enter the stock. After the hole has been drilled to the required depth, the cut-off tool is fed in and cuts off the finished piece, the action of the toolblock again changing the angle of the telescopic rod and causing the tailstock to move backward and the drill to be withdrawn from the hole. The operations are continued until all the stock extending from the chuck has been used. The carriage and the tailstock are then moved back to the original position and more stock is fed forward for the next piece.

Pivot-Type Adjustable Boring Head

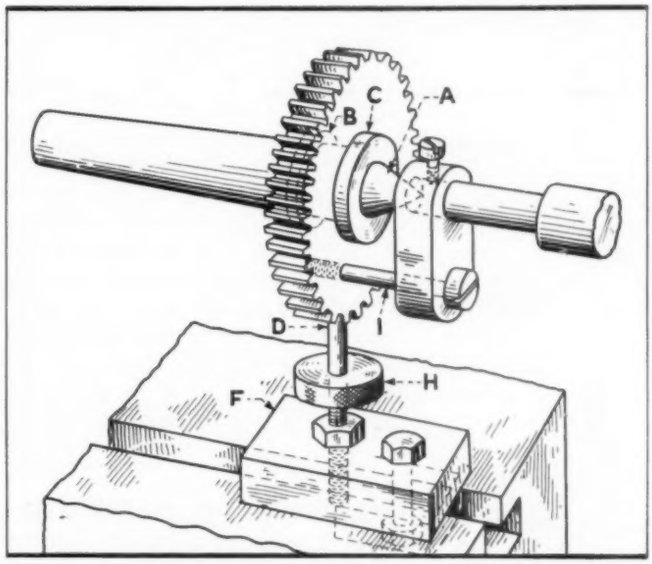
By MATTHEW HARRIS

A pivot-type boring head, which can move the cutting tool outward from center by using an adjusting screw with 20 threads per inch and a socket head graduated into 25 divisions, was recently described by J. A. Honeger (*AM*—Vol. 83, page 1004). If the adjusting screw were turned one division, it would move the inner end of the boring bar 0.002 in. But as near as can be told from Mr. Honegger's illustration, the distance from the pivot of the boring bar to its outer end is three times that from the pivot to the adjusting screw. Therefore, turning the adjusting screw one division will move the toolbit 0.006 in., resulting in the cut making the bored hole 0.012 in. larger than it should be. While somewhat closer results can be obtained by turning the screw part of one division, the exact amount of movement imparted to the toolbit will largely be guesswork.

Some Work Can Be Indexed in the Lathe

By JERRY BERARD

Small shops having limited equipment usually have no means of indexing, but it is an easy matter to rig up a lathe for such work in connection with a toolpost miller or grinder. Referring to the illustration, the



Work to be done by a toolpost miller or grinder can be indexed in the lathe by the use of the simple accessories described in the text

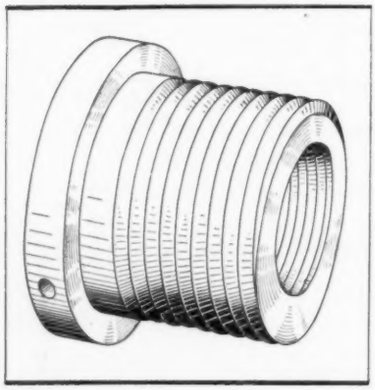
special headstock center *A* is made, having a shoulder at *B*. It is threaded for the nut *C* and the portion between the shoulder and the nut is turned to fit the bores of the change gears of the lathe, the gear selected for the work being mounted thereon and held against the shoulder by screwing up the nut. To insure

that the gear will not slip on the center, it is keyed thereto. After the center has been finished it should be hardened. The screw *D* is used as an index pin. It is contained in the tapped block *F* clamped to the lathe bed and its upper end is turned to fit the spaces between the gear teeth. The screw can be turned in or out of engagement with the gear by turning it by the knurled collar *H*. The driving pin passes through a clearance hole in the dog and is screwed into a hole tapped in one of the gear arms.

Adapters for Lathe Chucks

By WILLIAM A. SPELLMAN

One lathe chuck can be used on any lathe that will swing it by providing each lathe with an adapter such as the one illustrated. An adapter is fitted to the threaded spindle nose of each lathe on which the chuck is to be used, but the external threads on all adapters must fit the internal threads in the chuck



With adapters fitted to the spindle noses of all lathes and having external threads to fit the chuck plate, the same chuck can be used on any lathe that will swing it

plate; therefore, the threaded hole in the chuck plate must be large enough to fit the adapter for the lathe having the largest spindle nose. Thus, with the proper adapter fitted to the spindle nose of each lathe, the same chuck can be used on all the lathes. This of course is more applicable to small rather than large shops.

Since an adapter may be stuck on the spindle nose or in the chuck plate when the chuck is removed, it is a good plan to drill a hole in the flange of each adapter for a pin by which it can be unscrewed.

A Tailstock Plate Aids Scribing and Indicating

By ARTHUR SILVESTER

I question the economic value of a flat plate with a taper shank to fit a tailstock spindle as a means holding an indicator or height gage for checking the truth of chucked work. (*AM*—Vol. 83, page 1004). Why bring the tailstock so near the work when a plate laid across the lathe bed on which the base of the surface gage could rest would answer the purpose. If the work were rough on the periphery the indicator would not be required. If it were finished, or if but little sotck had to be removed, the base of a surface gage that was equipped with an indicator could be placed on the lathe bed or on the carriage.

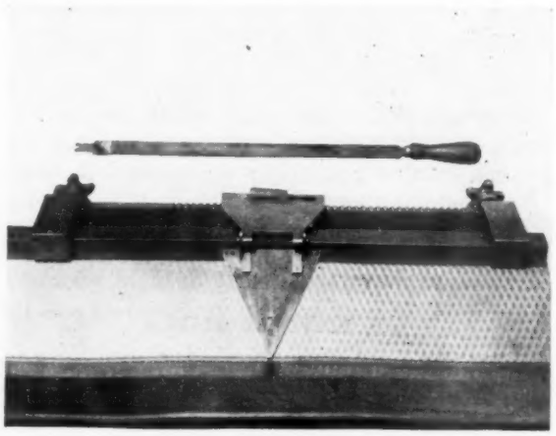
To make the device would take at least a day's work, plus the cost of overhead and material. It would either have to be forged or machined from a solid bar 6 in. in diameter, or the plate and the shank could be made separately, welded together and then finished. The plate would have to be parallel with the lathe bed in both directions, therefore it would have to be set by an indicator. Of course, it could be located in position by a key so that it could be automatically set in the correct position, but that would involve keyseating both the shank and the taper hole in the tailstock spindle. It will readily be seen that unless the plate is parallel with the lathe bed in both directions it would not be possible to scribe a line straight across the face of the work and parallel crosswise with the lathe bed by moving the base of the scribe block on the plate.

A Guide Simplifies Spotting Planer Ways

By FRANK C. HUDSON

Modern planing methods are so accurate that little or no scraping is required. But nearly all planed work is spotted, largely for appearance and partly to afford small oil pockets on the planed surfaces.

Most spotting is done "free hand" with a circular motion that gives a sort of dappled appearance. The Cincinnati Planer Co. has a method of producing a diamond shaped spotting that is very effective and can



Dappled appearance of machine tool ways can be produced with this guide and scraper in less time than by free-hand motion

be done rapidly. They use the illustrated guide, which has a spacer and a scraper with a double point.

The scraper is used each side of the guide, which is then moved one or two notches by the ratchet handle at the rear, and the operation repeated. After a section of the ways have been spotted, the guide frame is moved along the bed top new position and the operation requested. This makes a very efficient device which can be used in other places with equal facility.

Application of Nickel Cast Irons

Courtesy of the International Nickel Company

IN THE TABLE are listed applications applications of nickel cast irons to machine tool and machinery elements. These are essentially a summary of compositions in actual commercial use. Special considerations involving unusual design features or unique service may require adjustment of these compositions to produce optimum results.

The tensile strengths given were obtained with 1.20-in. diameter specimens conforming to A.S.T.E. Specifications A48-36. The Brinnell hardnesses are those obtained on casting.

Heat-treatment is used to relieve casting stresses by heating to 1,000 F., where they are held one hour for each inch of cross-section and then allowed to cool slowly. Where wear resistance with higher strengths is desired, castings of simple shape, section and contour may be oil quenched from 1,450–1,600 F and drawn at 500–1,000 F. The tensile strength is usually increased 20–30 per cent and the hardness approximately doubled, depending on the drawing temperature and composition. Exceptions are given in the footnotes.

APPLICATIONS, COMPOSITIONS AND PROPERTIES OF NICKEL CAST IRONS

Description of part	*Approximate section size*	*Chief service requirements*	*Typical chemical composition*					*Tensile strength, lb. per sq. in.*	*Brinell hardness*
			C	*Si*	*Ni*	*Cr*	*Mo*		
Bushings and bearings	L	Wear resistance, good machinability	3.50	1.80	1.50	0.30	(2)	33,000	200
	H	Wear resistance, good machinability	3.20	1.10	1.50	0.30	(2)	39,000	200
Break and clutch drums	L	Resistance to wear, scoring, and frictional heat	3.30	1.60	2.00	0.60	(2)	40,000	240
	H	Resistance to wear, scoring, and frictional heat	3.00	1.10	1.50	0.50	(2)	50,000	240
Cams	M	Resistance to wear, good machinability	3.30	1.80	1.25	0.30	(2)	35,000	200
	H	Resistance to wear, fair machinability	3.10	1.60	2.00	0.60	(2)	46,000	240 (3)
Chuck bodies	H	Toughness, close grain in heavy sections, excellent machinability	3.30	1.80	1.50	(1)	(2)	35,000	190
Cylinder liners	L	Pressure tightness, wear resistance	3.30	2.10	1.75	0.50	(2)	36,000	220 (3)
	M	Pressure tightness, wear resistance	3.10	1.60	1.50	0.40	(2)	42,000	220 (3)
	H	Pressure tightness, wear resistance	3.10	1.20	1.50	0.50	(2)	45,000	220
Dies	M	Resistance to wear, fair machinability	3.30	1.50	2.75	0.60	....	43,000	260 (4)
	H	Strength, resistance to wear	3.00	1.25	2.75	0.80	....	50,000	260 (4)
Flywheels	H	Strength, resistance to wear	2.70	2.10	2.00	0.40	0.40	65,000	260 (3)
	M	Soundness, good machinability	3.20	1.80	1.00	....	....	35,000	200
	H	Strength, soundness in heavy sections	3.00	1.10	2.00	....	0.25	55,000	240
Gears	M	Wear resistance, good machinability	3.30	1.50	1.25	....	....	38,000	200
	H	Wear resistance, soundness in heavy sections, fair machinability	3.20	1.10	2.00	0.30	(2)	48,000	240
	M	Strength, wear resistance, impact resistance	3.00	1.50	2.00	....	0.65	60,000	240
Gear cases	L	Soundness, good machinability	3.30	2.10	1.00	....	....	33,000	210
Machine tool beds, tables, saddles, slides	M	Resistance to wear and galling, soundness, good machinability	3.30	1.80	1.25	(1)	....	34,000	190
	H	Resistance to wear and galling, soundness, good machinability	3.20	1.10	1.50	(1)	....	40,000	210
Machinery frames, housings, bases	M	Soundness, good machinability	3.20	1.50	1.50	0.60	....	40,000	230
	M	Strength, high modulus, fair machinability	2.90	1.70	1.50	(1)	....	50,000	240
	H	Strength, high modulus, fair machinability	2.80	1.50	1.50	....	....	55,000	240
Pistons	L	Soundness, good machinability	3.40	2.30	1.00	....	0.30	30,000	200
	M	Soundness, good machinability	3.10	1.60	1.50	0.30	....	38,000	220
Piston rings — pot cast	L	Wear resistance, retention of spring tension	3.30	2.10	1.50	0.20	0.40	40,000	250
	M	Wear resistance, retention of spring tension	3.10	1.90	1.00	0.25	....	36,000	200
	M	West resistance, retention of spring tension	3.10	1.20	2.00	(1)	....	46,000	230
	L	Pressure tightness, wear resistance, good machinability	3.20	1.80	1.00	....	....	35,000	210
	M		3.10	1.60	1.50	0.40	(2)	42,000	220
Pressure castings — pumps, cylinders, valves, compressors, hydraulic machinery	M	Strength, pressure tightness, wear resistance, fair machinability	3.00	2.00	2.00	0.35	0.60	60,000	250
	H	Pressure tightness, wear resistance, good machinability	3.10	1.20	1.50	(1)	(2)	45,000	220
	H	Strength, pressure tightness, wear resistance, fair machinability	3.00	1.10	2.00	(1)	0.25	55,000	240
Rollers, tires	H	Compressive strength, wear resistance	2.90	1.70	1.50	0.20	....	50,000	240
Sheaves, sprockets, pulleys	M	Wear resistance, fair machinability	3.20	1.50	1.50	(1)	0.50	45,000	220

Section thickness: L = light, less than ¾ in.; M = medium, between ½ and 1¾ in.; H = heavy, over 1¾ in.

(1) For greater wear resistance and strength, chromium may be added up to about one-third of the indicated nickel content.

(2) Molybdenum may be added, with reciprocal reduction or elimination of chromium, where improvements in strength and toughness are desired.

(3) High Brinell hardnesses can be obtained by oil quenching and drawing. The required temperatures will vary, depending on composition and section size.

(4) To produce 300-400 Brinell, oil quench from 1550-1600 F. and draw from 700-1100 F. Properties given are on "as cast" material. Tensile strength of 65,000 lb. per sq. in., and Brinell hardness of 350 can be obtained by oil quenching from 1500 F and drawing from 900 F. Tensile strength of 50,000 lb. per sq. in., and Brinell of 450 can be obtained by oil quenching from 1500 F. and drawing from 450 F.

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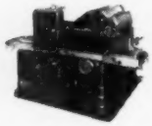
STYLE No. 31



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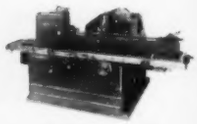

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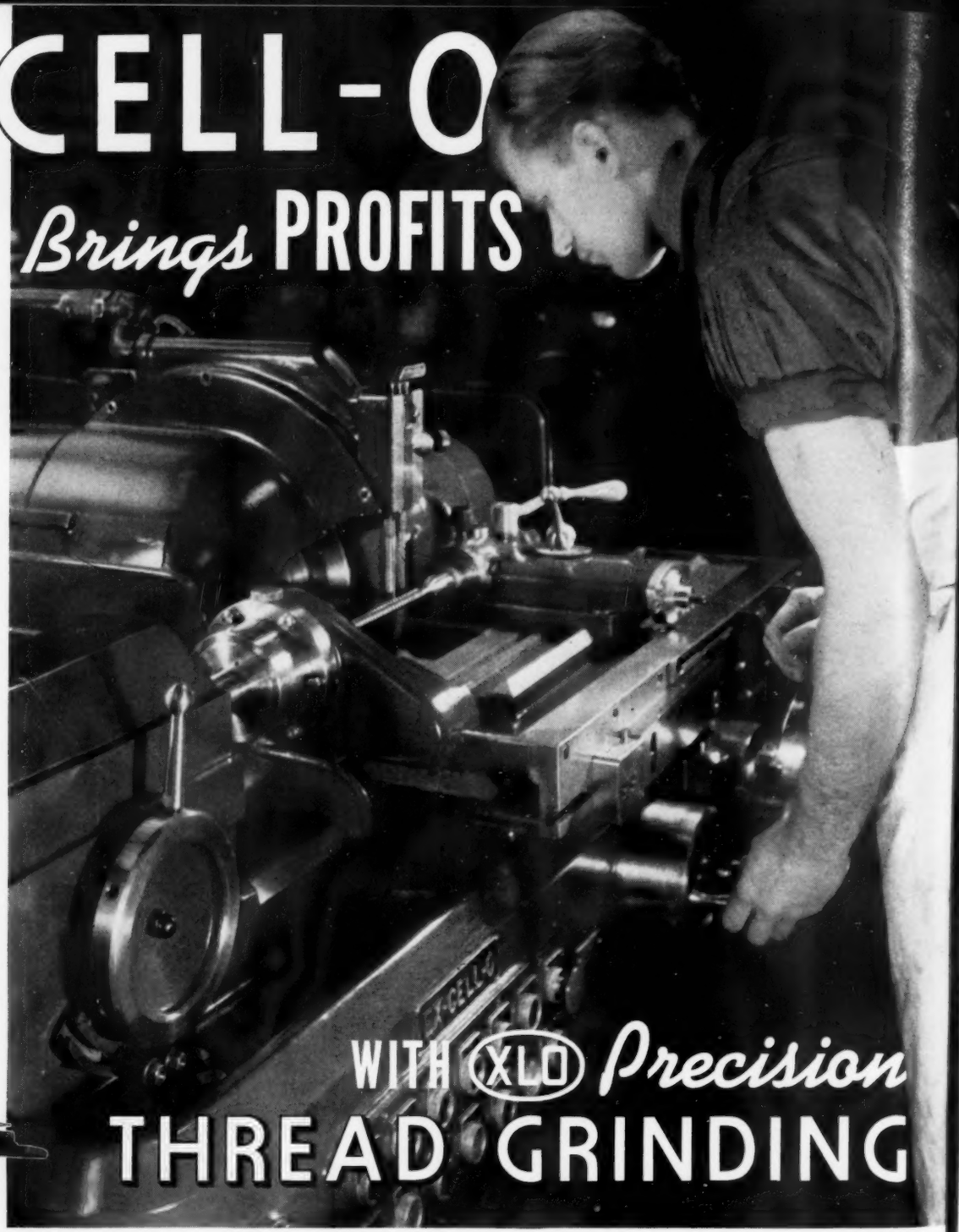

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Questions for the Diemaker

BY **H. B. FAUGHT**

WHEN LAYING OUT DIES, the following questions are useful for checking each item to determine whether or not they have been given consideration. This list deals particularly with progressive, compound, and plain blanking dies. For other types a similar list may be compiled to suit the general requirements.

1. In laying out the die, have the following items been considered: (*a*) Economical stock layout; (*b*) angle of layout in relation to the grain of the stock; (*c*) direction from which the stock is fed; (*d*) strength of the die; (*e*) center-line of pressure; (*f*) length of feed stroke, making it as short as practical; (*g*) proper scrap allowances; (*h*) auxiliary perforating punches and pilots (if required); location of pilots, so as not to pierce the stock on the first stroke; and (*j*) shaving operations for which, if they are required, allowance for shaving must be made in the blanking tool?

2. Will the die be suitable for the press for which it was intended, in regard to fit and press speed?

3. Has power, bolster plate, die space and knockout been considered?

4. Has safety to the operator, tool and machine been considered?

5. Has the die been made large enough to prevent cracking during the hardening operation?

6. Is the die of sufficient thickness to withstand repeated shocks and to prevent excessive warping during hardening?

7. Should the die be made in sections to facilitate making, heat-treating and repairing?

8. Are "breakdowns" or inserts and bushings provided to facilitate making, heat-treating, and replacement of worn or broken sections?

9. Has the die been provided with sufficient clearance to enable the slugs to fall through?

10. Has the proper grade of tool steel been specified for the cutting members?

11. Has shear been provided on the die in a case where the power required to punch a part has reached the maximum?

12. Does the die shoe provide sufficient support for all members, including sides and ends as well as the bottom?

13. Is it necessary to use line-up pins? If so, are they placed far enough apart to function properly? Are they large enough to insure sufficient rigidity?

14. Has clamping provision been made so as to use the bolster plate planned on?

15. Has the proper type of stripper been considered?

16. Is the stripper heavy enough to strip the stock without becoming distorted?

17. Should the stripper be hardened and ground?

18. Are bushings necessary to guide perforating punches? If so, have they been provided in the stripper?

19. Is a stock guide necessary for proper and convenient operation?

20. Is each finger stop placed to avoid cutting on one edge of the blanking die?

21. Is each automatic stop located to prevent the working end of the stop from catching in a projection of the scrap stock?

22. Has the stripper opening been made convenient for feeding a new strip of stock?

23. Should the stripper be equipped with a stock guide?

24. Should the stripper guide the punch all around?

25. Have heel punches been reinforced with fillets as large as is consistently possible for additional strength and to facilitate hardening?

26. If pilots are used in the punches, are they made easily removable to facilitate grinding the punch?

27. Should the punch be made in sections to facilitate making and heat-treating?

28. Should the punch be hardened?

29. Have dowels been spaced far enough apart in the die in order to be most effective?

30. Are the pilots tapered gradually enough so as not to pull the holes out of shape?

31. Are the perforating punches sufficiently reinforced?

32. Are the perforating punches of small diameter backed up sufficiently to keep them from wearing into the cast-iron holder?

33. Have the large perforating punches been made longer, to insure their entering the stock before the small ones and thus avoid the effects of bulging stock?

34. Are screws placed in the punch plate in the most effective location?

35. If other operations are included in perforating and blanking tools, such as stamping and embossing, have buffers been provided?

36. Be sure that no spring plungers are made blind when they require grinding or adjustment.

37. Check location and action of vacuum or release pins.

38. In designing the die, has the kind of stock to be punched, heat-treating equipment available, and tool cost been considered?

39. If there is a possibility of future requirements, has this been considered in designing the die?

40. Has the burr side been considered when other parts are to be assembled to the blank?

41. Have punches of odd-shaped contour and round shanks been pinned, doweled, or otherwise secured to prevent them from turning? This applies to breakdowns and inserts in the die block.

42. If a notching operation is to be performed, has the punch been sufficiently backed up to prevent being crowded away from the edge of the die?

43. Has provision been made if holes come outside the opening in the bolster plate?

44. Will scrap cutters be required?

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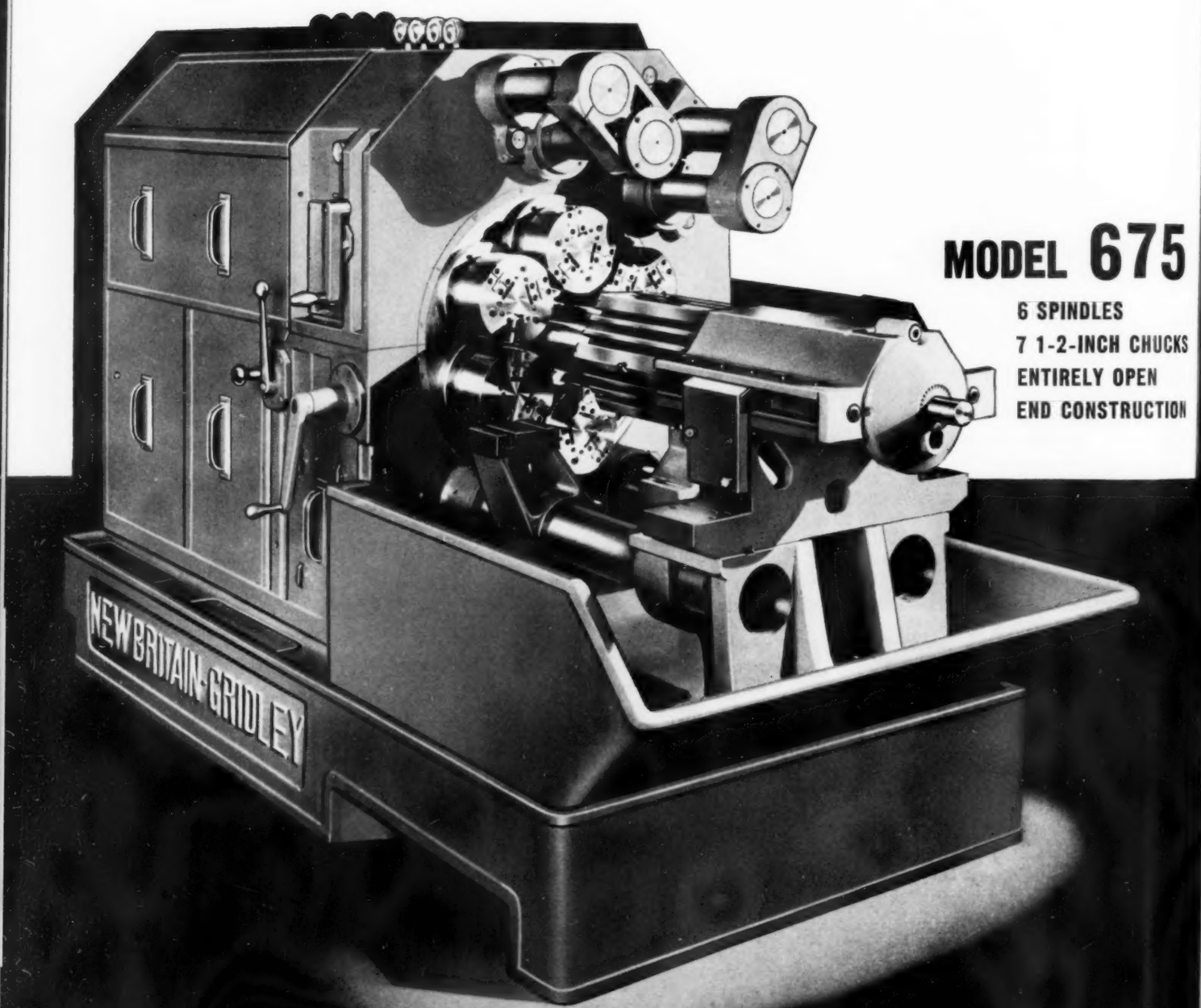

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"Backward, Turn Backward—"

BACK IN '33 we heard a lot about slaughtering pigs because hog prices to the farmer were too low. Fewer pigs and higher hog prices was the idea. So the government proceeded with a mass pig execution program. The price of pork soared sky-high as a result. So much criticism was leveled at this form of limiting the supply of goods that the government was glad when the public's mind was diverted to other things.

At various times since then the government has advocated an economy of scarcity rather than of abundance. Now it remains for Senator Joseph C. O'Mahoney to drag out into public light a bill to "balance men and machines." Employers who would produce goods with a more than average use of manpower would be rewarded. Those who took advantage of the latest technological advances by a more than average use of machines would be penalized by extra taxes.

Designed for the praiseworthy purpose of relieving unemployment, this bill would work just the opposite. It is directly contrary to American industry's policy of producing more goods for more people. It would substitute in its stead a policy of fewer goods for fewer people.

For what other conclusion can one draw from a measure which deliberately puts a barrier in the path of technological progress? Industry in this country has been built on the basis of a continuous lowering of consumer prices, thus widening markets and creating more employment. Those prices would not be at rock bottom unless goods could be made in mass production at the lowest possible cost. Employment of unnecessary labor inevitably would force up costs and in turn raise prices to the consumer. Shrinkage of markets would follow.

If Senator O'Mahoney wants to put men to work by taxing machines, where does he intend to stop? Would he have automobiles produced by hand? Why not eliminate mechanical handling and have men use their muscles more and pushbuttons less? The answer is the men themselves would rebel; they wouldn't go back to the hard physical grind which they are now spared.

Instead of putting great sheets of steel through stamping presses to be formed into automobile bodies, why not have the bodies hammered out by hand? If machinery were tossed out of motor car factories and men substituted, more men would be employed—temporarily. But production would drop like a falling star. Automobiles could be made that way, but you couldn't buy them for $700. You would be lucky to get one for $3000. Instead of a car in every garage, there might be one in every thousand garages.

The same might be said of almost every product which we are accustomed to in everyday life. Instead of being a part of every household, they would be priced so high that people no longer could afford them.

No, Senator, taxing the efficiency of American industry, placing a penalty on good management, is no way to take up the slack in unemployment. It is necessary to look elsewhere for the remedy.

Burnham Finney

GAGING BUSINESS

Machine tool industry broadens operations as it increases its capacity. Airplane people, wanting 2,000 machines, are biggest buyers. Domestic customers being given preference over foreign

Spring seems more likely to bring an intensification rather than a slackening of operations in the metalworking industry. Several branches of the industry, particularly machine tool builders and aircraft makers, are loaded with work for months ahead.

MACHINE TOOLS—Officially the machine tool industry is running at 92.9 per cent, or at approximately the same rate as the past three months. Actually, however, operations have broadened because the industry's capacity has increased somewhat in that time. Business continues to pour in in unprecedented volume. The largest single buyer has been the airplane industry which is in the midst of a major expansion program to meet Allied needs. Some 2,000 machines are reported on order by the aircraft people for rush delivery. Other domestic bookings have been substantial, especially from the army and navy, automobile makers, companies with ordnance contracts, and machine tool builders themselves. Dealers dependent exclusively on domestic orders say that business is good and well diversified. Regular U. S. customers continue to be given preference over foreign buyers. French and British purchases are extremely large, but tight terms are being exacted. The Allies are understood to have offered strong financial inducements to some builders to increase their plant capacities so that they can fill orders faster. Japanese and Russian business is being discouraged by extremely long delivery dates and strictly cash demands.

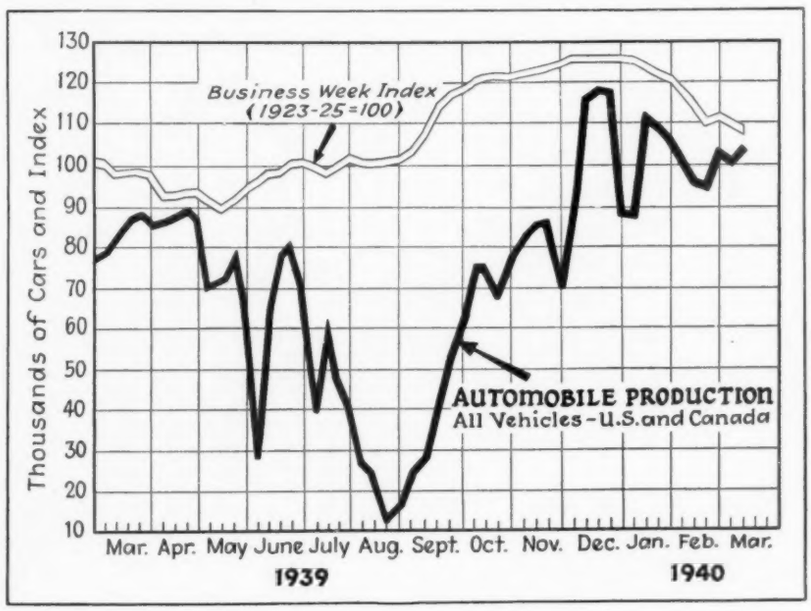
AIRCRAFT — The Allies' buying program for 8,000 planes plus "spare" engines is expected this week to add tremendously to backlogs of airplane companies. Consolidated is reported to have received a $9,000,000 order for patrol bombers from the Allies. Norway has bought 24 Northrup bombers. Further orders are anticipated from Scandinavian countries. Allison Division of General Motors is said to have accepted an order for motors for 700P-40 bombing planes from Britain and France. Until now it has been making engines exclusively for U. S. defense forces. The Allies' order will help defray expenses of extensive plant and tool expansion. Aircraft engine companies are in the final stages of tooling for plant enlargements; when completed, at least one maker will be able to produce 1,000 units a month. Lockheed is spending $1,000,000 for factory expansion. The navy has contracted with Pratt & Whitney aircraft for engines valued at $7,952,766.

ORDNANCE — The Allies have placed additional orders in this country for shell forgings. A $50,000,000 inquiry by the French for magnetic mines is said to have been rejected by one company which refuses to upset its production of peacetime goods. Winchester is understood to have been working the past few weeks on a substantial order for guns and ammunition for the Finns. Should intensive fighting develop on the Western Front, the Allies are reported to have about a 30-days' supply of shells on hand. That is why the French and British are interested in buying shells and shell machining equipment here.

RAILROAD EQUIPMENT—Freight car orders in the first two months of 1940 dropped to 1381 compared with 2007 in the same period a year ago. On the other hand, contracts were placed for 24 steam and 22 diesel-electric locomotives, as against 11 diesel-electrics last year. The Milwaukee Road's budget includes provision for 2,000 steel box cars to be built in its own shops at Milwaukee, 10 freight locomotives from Baldwin and 18 diesel-electric switchers. Budd has received an order for 28 stainless steel cars from the Portuguese National Railway. Iranian State Railways are inquiring for 12 to 24 locomotives. The Santa Fe has bought four diesel-electric locomotives and Lackawanna 14 switchers.

FARM EQUIPMENT — Manufacturers are optimistic as the first quarter shows improvement over last year and farm income is up because of government payments. Farmers may delay buying, however, on account of world conditions, poor wheat prospects and low-priced hogs. International Harvester has announced a $1,000,000 expansion of its Rock Island plant where its new 4-ft. combine (selling at $405) will be made. The new small combines have opened up new fields for farm mechanization.

STEEL — Though mills, at 64 per cent of capacity, have halted the downward trend of operations, incoming business still is insufficient to support present output. How long users will consume more than they buy is anybody's guess. However, no further drastic decline in production is looked for.



PLANE ORDERS FAR EXCEED 1940 OUTPUT

Delay of Allies in buying planes prevented serious shortage of engines. Engine builders now making final purchases for plant tooling problems. Industry to employ 90,000 men by autumn

BY BLAINE STUBBLEFIELD

WASHINGTON—With the Allies finally making up their minds what kind of planes they wish and what proportion should be bombers as against pursuit craft, the airplane industry's biggest expansion is under way. Backlogs are about to pass $1,000,000,000, yet in 1940 the industry cannot possibly produce more than $600,000,000 of planes, engines and parts.

The only factor which has prevented a serious shortage of airplane engines, thus holding back airplane assemblies, has been the indecision of the French and British about their buying programs. As it is, tooling plans at Pratt & Whitney Aircraft and Wright Aeronautical have been partially delayed because the kind of engines desired was not known until the past few days. Allison Division of General Motors is reported three months behind in filling aircraft engine orders.

Machines Now Being Bought

There are three phases to the equipment buying programs at Pratt & Whitney Aircraft and Wright Aeronautical. Purchases have been completed for the first two phases and deliveries of machine tools are to be made prior to July 1. Buying for the final phase is in progress this week. When this whole expansion program is completed, no engine shortage will exist. In one plant alone, for example, it will be possible before the end of the year to build around 1000 motors a month.

By late autumn the aircraft and aircraft engine industry expects to employ 90,000 to 100,000 shop men. Today the total is 60,000, with 46,500 on airplanes and 13,500 on engines. This compares with 13,000 on both airplanes and engines back in 1934.

Facts on Plane Costs

Facts about production of planes were easy to get a year ago, but hard to get now. AMERICAN MACHINIST has secured reliable data, however. A four-engine heavy bomber, in lots of 50 to less, burns up between 80,000 and 100,000 man-hours of labor. An average all-metal single-engine pursuit ship, in lots of 200 or 300, takes 5500 to 7500 man-hours to build. A two-engine light bomber, in orders of around 100, works 100 men something like 200 hours each. Training planes, the most numerous of all military types, require 1800 to 2300 man-hours each in orders of several hundred.

If you were to guess that it takes around 1500 man-hours to build a double-row radial air-cooled 1000-hp. engine of the type which is standard on big transport planes and on several army and navy specifications, you wouldn't be far wrong. That is on a production basis of 200 to 300 a month. The 200-hp. job requires 300 to 500 man-hours.

In the fighting plane business a number of rules of thumb serve as guides. Some material men cut the cost of a plane into three parts: one-third labor, one-third material and one-third overhead. It is said that, roughly, shop employees produce 1.1 engines each per year. The average cost of an engine, if you leave out the flivver type, is $6000. It takes one man-hour per pound of metal airplane, including the engine. The selling price of engines is $10 to $15 per horsepower. Engines average 1½ lb. per horsepower. Engines sell for about $8 a lb. These recipes are offered so that amateurs will not follow them to whip up a product.

Companies exporting and contracting to the government are working two or three shifts. Small plane factories, in contrast, are working only a single shift which is usually eight hours. Not one plant is believed operating at full 24-hr. capacity in all departments.

Nobody knows top airplane productive capacity of the United States. Estimates based on present capacity and ability to expand put possible 1941 output as high as 15,000 units.

U. S. PLANTS MUST STAY HOME

WASHINGTON—American munitions men and one plane manufacturer have made gestures toward setting up shop in Canada. But the War Department is reported to have stopped them. It has no legal authority to that end, but can accomplish the result in the munitions field on the ground that military secrets must stay at home. A piece of team work with the U. S. is an order by Canada removing customs duty on materials to be used in manufacture of Allied war contracts, retroactive to September 2, 1939. It seems to be agreed that Canada can have supplies and accessories, but not our industries.

British Combine

Handiwork—*"One million women will be needed for Britain's war industry," asserted Winston Churchill, First Lord of the Admiralty, in a recent pronouncement. Large numbers of girls are already being trained to replace men in the Ministry of Supply munitions plant where this photograph was taken*

Wide World

French Line—*Light tanks in enormous numbers come rolling off these assembly lines improvised in a spacious armament factory "somewhere in France"*

Air Corps Procurement Centered in Three Areas

DAYTON— Major A. M. Drake, in charge of Air Corps Procurement Office at Detroit the past three years, has been promoted to lieutenant colonel and transferred here where he will be senior officer of the newly created Central District Planning Division for Industrial Mobilization of the Air Corps. Procurement officers in several manufacturing centers are being transferred to three new divisions, the Eastern District at New York, the Central Division at Wright Field, and the Western District at Los Angeles. Inspectors working out of the original offices will not be affected. Lt. Col. Drake will be in close touch with purchasing and inspection divisions at Wright Field and will be available to manufacturers and other suppliers in the Central District during their trips to Dayton. Lt. Col. Drake and his staff will be able to reach vendors throughout the headquarters district by plane from Dayton in most cases.

Allies May Get Plane Designs

WASHINGTON—The Administration is presenting a united front against Congressional criticism that the Army and Navy are permitting planes of U. S. secret military design to be sold to the Allies. On top of Assistant Secretary of War Louis Johnson's denial that national defense programs are suffering because the government has given the Allies priority in plane deliveries, comes Secretary of the Treasury Morgenthau's suggestion that an investigation of his part in aircraft procurement will be welcomed.

War Department officials will back up the Administration on one point. They believe that if late type planes are made available to Britain and France, the resulting orders will help build up the U. S. plane industry to an efficient point highly desirable from a national defense angle with the least possible cost to the U. S. Government. On the other hand, some military officials are not pleased at the way in which chief contact between the Allies and U. S. industry in connection with ordnance procurement has been taken out of their hands by the White House and lodged in the Procurement Division of the Treasury.

NAVY LETS BIG ENGINE ORDER

DETROIT—The Packard Motor Car Co. has accepted a $2,000,000 contract for the production of super-marine engines of 1,200-hp. each to be used by the Navy for high-speed surface torpedo craft. The contract for some of these boats was let to the Electric Boat Co., Groton, Conn., earlier this year.

The engine is a development of the V-12 cylinder water-cooled aircraft engine originally developed for the Army and Navy air services. A total of $261,000 is being spent by Packard in the development and testing of seven experimental engines according to M. M. Gilman, president of Packard. The balance of the $2,000,000 will be spent in the construction and delivery of 81 engines for Navy boats now under construction.

Canada Will Increase Machine Buying to Fill Allied Orders

MONTREAL—British and French expenditures for war materials in Canada during the next 12 months are estimated by Canadian government officials at a minimum of $500,000,000. Canadian war expenditures are expected to increase, if anything, over present rate of over $1,000,000 a day. Thus, heavy Canadian purchases of American equipment, tools, machinery and parts, as well as of industrial raw materials, are indicated.

Shell and Gun Order Heavy

Canadian Car & Foundry Co., Ltd., of Montreal, has received a substantial British contract for manufacture of shells of large size. Although details are unavailable, it is understood the order is to be followed by much larger orders on satisfactory completion of initial deliveries.

Dominion Foundries & Steel, Ltd., of Toronto, has started an addition to its open-hearth building to house equipment for manufacture of barrels for anti-aircraft guns. A new temper mill is not yet in operation due to delayed delivery of required machines.

Canadian locomotive manufacturers have received a number of enquiries from Iran, Turkey, Spain, Brazil, Argentina and other prospective foreign buyers of locomotives, in recent weeks.

Canadian Car & Foundry Co. has completed initial deliveries to England, on its contract for supplying 40 Hurricane fighting aircraft to the British government. Negotiations on another contract for delivery of more Hurricanes are completed, or nearly so.

Shipyards Change Hands

Canada Steamship Lines, Ltd., has sold its shipyards, located at Midland, Ont., to a syndicate headed by R. M. Wolvin of Montreal.

St. John Drydock & Shipbuilding Co. has received a contract from the Canadian government for construction of three anti-submarine boats at a cost of $1,900,000.

Recently announced contracts awarded by the Canadian government War Supply Board include: Aircraft supplies—Noorduyn Aviation, Ltd., $47,286; Fleet Aircraft, Ltd., $18,829; Canadian Vickers, Ltd., $10,843; Engineering Products of Canada, Ltd., $51,794; British Air Ministry, $12,552. Machinery—Waterbury Farrel Foundry & Machine Co., $243,100; E. B. Bliss & Co., $173,087; John Robertson Co., Brooklyn, N. Y., $22,668; Ferracute Machine Co., Bridgeton, N. J., $24,962; Williams & Wilson, Ltd., Montreal, $17,988; Electrical equipment—British Admiralty, $51,560. Munitions—Remington Arms Co., Inc., $175,766; British War Office, $21,000.

INSIDE DETROIT

Equipment buying slowed down by delayed deliveries and by lack of mechanical changes for '41 models. Automotive spokesmen resist machine tool priority system favoring aircraft industry

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT—An appraisal of equipment actually ordered for the 1941 automobile production season bears out earlier predictions that on the whole the industry would refrain from general replacement programs, to concentrate upon a few new items and a limited number of cost-cutting installations. The spotty character of the market is indicated by reports that some equipment builders have been lucky enough to surpass last quarter by 200-300 per cent, others see no improvement over last year, while those selling large general lines declare that the quarter should prove ten per cent off from last year. But total buying for the 1941 season is believed ahead of purchases made for the present models.

Automobile companies made plenty of money in 1939 and confidently expect a bigger year in 1940, so there must be strong underlying reasons why they have refrained from buying new equipment that could be expected to pay for itself in a matter of a few months. Inquiries among master mechanics and manufacturing executives disclose the following reasons why buying has not been more general: (1) fear of a priority scheme whereby the government would require machine tool builders to favor those engaged in national defense programs, (2) dissatisfaction with delivery dates, (3) a belief that machine tool builders will be over the hump by next fall, and can give adequate engineering attention and delivery for the 1942 model season, and (4) there will not be many mechanical changes absolutely requiring new machines.

Strong Sales Ups Output

Everybody will be happy if record new-car sales during the last ten days of February continue, although some are worried by used cars failing to keep pace. But Chevrolet, which showed a 65 per cent gain for the last period, declares the field stocks of used cars actually declined; this company is shooting at 100,000 new-car sales in March as contrasted with 74,932 in February. Some producers have lifted March schedules 10 per cent over original quotas in an effort to keep field stocks balanced with soaring sales. April quotas are set for higher figures than attained so far in the 1940 model run. Second-quarter production is likely to reach 1,450,000 units; add the 1,310,000 for the first 90 days, and the total output for the first six months should approximate 2,600,000, or about 30 per cent more than the first half of 1939.

Machine Deliveries a Problem

Last fall, expanding production of aircraft engines cast a shadow upon procurement of machine tools with reasonable delivery dates. Top automobile executives were frankly worried about the situation. When delivery conditions did not improve, and the threat of government intervention became apparent, the net effect was to freeze automotive buying to barest essentials. One manufacturing executive stated definitely that his management had decided only recently to forego any replacement programs this year. Enough modernization had been done during the last few years to enable his plant to get by until the 1942 season. Cost-cutting programs had been under consideration, but they were cancelled.

On the other hand, the management of one large producer gave no attention to this situation and has just placed a larger volume of business than last year, principally equipment for new-model design changes. The informant stated: "We are getting what we want and have not been hurt by the delivery situation." Where the preferred vendor was unable to fill the order, the business was switched to the second or third choice. Precision boring mills and heavy grinders were the only ones difficult or impossible to get. By and large, the company has been able to get all the equipment it wanted.

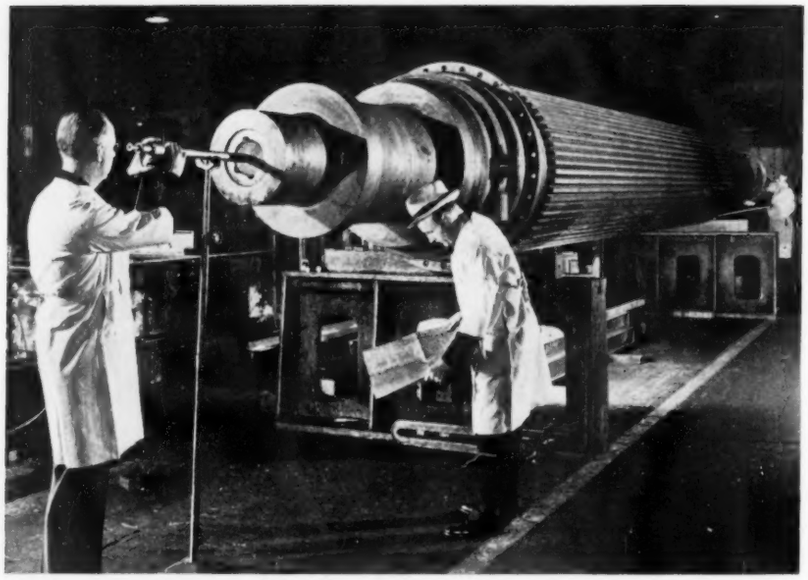
With the delivery situation what it is, there is little likelihood that

MAKERS DECIDE ON MODELS

DETROIT—All signs indicate that Chevrolet and Plymouth in 1941 will not compete in the "economy" field now occupied by the Studebaker Champion, the Willys and toward which the Nash light six and the Ford six are aimed. No equipment programs have been discussed and it is now too late to embark upon such a venture. Besides, company spokesmen point to continued success in the price class now occupied, and expect that record to be sustained next year with a new high in styling.

Close Look

Vigilant inspection of Chrysler fluid drive assemblies helps insure best performance when in service. This inspector is making sure the hydraulic seal face is flat and flawless. Dimensions of various parts are checked with sleeve gages, some superfinished for extreme accuracy



Periscope—*Allis-Chalmers inspects the bore of one of the world's largest generator shafts with a periscope to make sure there are no flaws in the metal*

the second quarter will be productive of much business. Two cases that come to mind are possible further purchases by Buick, for its expansion project, and a small amount of equipment for a larger automatic transmission that Detroit Transmission is said to be contemplating for limited production. Many of the parts would be interchangeable with the transmission now being manufactured for Oldsmobile.

Tooling Projects Restricted

A summation of tooling-up projects placed during the first quarter shows definitely the tendency to restrict purchasing almost entirely to two new sixes and to a few cost-saving programs. Ford was the largest purchaser, having placed the bulk of equipment needs for the new six during the first part of March. Cadillac made a small buy a few weeks ago for expansion of the Allison engine contract. Dodge bought a line for production of a new vacuum-operated transmission. Oldsmobile has just placed some equipment for cost-cutting purposes on its engine, but reduced the original amount to avoid late deliveries. Buick had a good-sized program about the first of the year, principally to expand production and cut costs on its smaller engine. More orders from that source are being talked of but people wonder how deliveries can be made. Nash tooled up before Buick for a new light six for 1941 announcement. That company has been embarrassed by reports the car would appear this spring. Fisher Body has quietly been placing some press business. Chevrolet Gear & Axle bought approximately a score of new presses.

Enough business was secured from these commitments for a number of suppliers to say that orders the first quarter of this year were 100, 200, or even 300 per cent ahead of last year, But on the other hand many types of equipment either did not figure at all, or their vendors were only moderately successful.

The Ford Six took another step toward actuality when the bulk of the new equipment was placed. Estimated hourly production will be 75 units, or 1200 from two shifts. That number should account for approximately one-fourth of strictly Ford production, when both the six and the V-85 are running at full capacity.

Purchases for this project began to trickle out last fall, but inquiries did not reach flood stage until January and February. Since Ford has seen fit to cancel plans for a six in the past, and has scrapped entire production lines installed for that purpose, the purchase of isolated machines was no sign that the organization would actually go ahead with the OMA job. And those familiar with practices at the Rouge Plant will not guarantee that the six will be built until they actually see the car offered for sale.

The Ford Six Comes Along

The Ford six is said to be a completely new job throughout, unlike the V-60 which used many parts and the body interchangeably with the V-85. Equipment has been bought for the motor, differential and transmission, with some doubt existing as to whether a new transmission will be featured, or that a present transmission, either V-60 or V-85, will be used. Much machinery that has been used on the 60 has been rebuilt for the six. The general production scheme for the six tends toward the use of medium-output rather than high-production equipment used for the 85.

Performance of the six is said to be better than the V-85, particularly acceleration. This is not strange considering the reported lighter weight of the car and the torque characteristics of a six-cylinder engine. But fear has been expressed that the six may be junked if it outshines the 85 in too many respects. Little credence is given that conclusion, however, because power output of the eight-cylinder job can be stepped up easily.

Cadillac's recent buy for the Allison engine work being done in its plant (crankshafts, camshafts and connecting rods) marks the fourth expansion in production since the project was begun a year ago. Almost $2,000,000 worth of equipment has been bought altogether, but the recent buy was comparatively small, and may mark the end of such business for awhile.

Dodge Will Buy Machine Tools

By spending several hundred thousand dollars on machine tools for a new vacuum-operated transmission, Dodge will be in a position to produce 65 units per hour, or approximately 1300 per day. That figure is close to half of the Dodge output. Details of the transmission are unknown, except that it will not involve the difficult manufacturing problems of the automatic transmission.

Sufficient output should be available to supply the vacuum transmission on Plymouth, Dodge and DeSoto as optional equipment. More equipment was also purchased for the fluid clutch, which is offered optionally on the Chrysler line.

PLANE BUILDERS TAKE CRAFTSMEN

DETROIT—Aircraft engine builders in the East are reported to have pulled a couple of fast ones on the automobile industry. About the first of March, one company is understood to have hired away a goodly number of skilled tool and die makers with promises of better pay and a long working season. The following week another builder is said to have placed tool and die business with Detroit and Ohio shops worth up to a million dollars, according to estimates. Manufacturing executives and top bosses are frankly worried about the situation, even where they have contracted in advance for adequate time. Their reasons are (1) tools and dies must be finished by the first of June this year, (2) the scarcity of men may delay programs even where adequate time has been taken, and (3) the industry as a whole has the largest program in history and someone is likely to get squeezed.

WATCHING WASHINGTON

Though recommendations of the Smith committee for revising the Wagner Act have stirred up a storm, chances of changes are slim. Proposed blacklist of violators seems unlikely

McGRAW-HILL WASHINGTON BUREAU; PAUL WOOTON, CHIEF

WASHINGTON — Recommendations of the House committee headed by Representative Howard Smith for revising the National Labor Relations Act have stirred up a storm in the capitol. The Smith committee would ditch the present Labor Board and create a new one of three members. This board would sit only as a judge, the investigations and prosecutions being handled by a new administrator. A move for a collective bargaining election could be made only by the employer or his employees and not by the board. The CIO or AFL could not drag the board into a controversy regarding the type of bargaining unit in a plant.

Employers would be given the privilege of discussing any subject, including labor problems, with their men provided there was no threat of discrimination, intimidation or coercion. Neither an employer nor a union would be compelled to reach a collective bargaining agreement. Any charges of violation of the law would have to be filed within six months after the infraction. Orders for back pay would cover not more than six months. The language in the present law encouraging collective bargaining would be eliminated except for the statement that Congress should do all it can to protect workers' exercise of that right. If a worker willfully engaged in violence or unlawful seizure or destruction of property, the board would not have power to reinstate him. Board hearings would conform to the usual rules of evidence, the courts being permitted to review board decisions in representation cases.

Though manufacturers may toss their hats in the air in behalf of the Smith committee's proposals, they have slight chance of passage. The administration will be successful in stalling them off, thus saving all hands the agony of pre-election declarations on this red-hot issue. The CIO has come out against the amendments; the President is reported against them too. They are likely to be buried in the labor committee of the House of which Mrs. Mary Norton is chairman. About the only way Representative Smith can get them out of that committee is by petition of House members, and that is a difficult task.

Indications are stronger than ever that the only probable relief for employers will be dismissal by the President of NLRB Chairman Madden and possibly Smith, and appointment of one or two men who would vote with Leiserson. Interested persons would do well to count on no change at all; then any action by the President or by Congress will be all velvet.

Blacklist of NLRB Violators Unlikely

Pro-laborites pressing for amendment of the Walsh-Healy Public Contracts Act seem liable to disappointment this session. At present the labor standards restrictions on government contracts apply only to orders of $10,000 or more. The amendments would reduce that minimum to $4,000 or perhaps $2,000. The reformers also want to blacklist companies convicted of violating the Wagner Labor Relations Act. The Administration is in no position to push the amendments, what with so many people sore about the NLRB mess. Then too, the War and Navy and Treasury (Procurement) Departments are opposing the Walsh-Healy changes because they don't want any more confusion in national defense purchasing.

WAR BOOSTS SHIP WORK

WASHINGTON—Probability is increasing that this country at the close of the war will find itself in the lead of world shipbuilding and navigation. Though the neutrality law beached much of the American-flag foreign service, the older equipment in disuse is finding a ready market abroad, at good prices. Since outbreak of war, 98 ships, totaling 500,000 tons, have been sold. Another advantage to this country is increasing repair and overhaul of foreign-flag ships in American yards, according to a survey by the New York *Journal of Commerce*. Since the first of September, 141 foreign vessels have been drydocked here, as compared with 204 American ships. (One diesel installation job cost $80,000 here, as compared with $55,000 in Norway.) Incidentally, the Maritime Commission is now entirely out of the ship operating business, the last of the government lines having been sold to bidders.

End of 1940 Educational Awards Near

Recent educational orders awards bring the total 1940 expenditure to $6,510,732. About $5,176,000 went for ordnance; something over $1,000,000 for chemical equipment; and over $100,000 for signal corps equipment. During the last few days the War Department has made two batches of awards. One was for a total of $753,119 including $154,082 to Chrysler Corp. for cartridge cases, and $76,689 to W. C. Norris Manufacturing, of Tulsa, for shell machining. The other series totaled $381,202, including $153,152 to Scoville for fuses and $99,425 to Mergenthaler Linotype for telescopes. About $7,740,000 of $14.250,000 appropriated for fiscal 1940 remains to be allotted. It is expected that most of the large awards will have been made by early May.

War Department Will Study Cost of Planes

The War Department has asked the National Academy of Sciences to make an exhaustive study of U. S. aircraft production, with a view to determining unit cost of defense equipment, and the possibilities for expanded production. Congress appropriated $50,000 for the purpose. The Academy was called upon because it just delivered, under orders from President Roosevelt, a beautiful report on the relative merits of a number of blind-landing systems, which government agencies and manufacturers were bickering about. The Academy's report will be unspectacular but important. Whether it will be made public is not yet known.

Congress Cool to Taxing Machines

Senator Joseph O'Mahoney's proposal to tax "more than average" use of machine power and pay bonuses to employers increasing man power receives little attention here. The New Deal long ago played with this idea in connection with "profit sharing," and shied away. Serious observers say that since the machine system has proved successful in multiplying production with less labor, we had better try to make it work economically rather than curtail it and force hand labor. Chances are that the scheme will go back into the Congressional waste basket.

A.S.T.E. to Hold Machine and Tool Show At Annual Meeting in Detroit in 1941

First *to congratulate A. H. d'Arcambal on his election as A.S.T.E. president was retiring president James R. Weaver, right, director of equipment, inspection, purchases and tests, Westinghouse Electric & Mfg. Co.*

Speakers *included Warner & Swasey Co. executive vice-president Clifford S. Stilwell, immediately below, and Carboloy Co. president W. G. Robbins, bottom. Mr. Stilwell analyzed tool education requirements; Mr. Robbins discussed carbide tools*

NEW YORK—Directors of the American Society of Tool Engineers, meeting here during the annual convention of the Society March 7–9, decided to hold a machine and tool exhibition in connection with the 1941 annual meeting scheduled for Detroit, March 10–15, 1941. A semi-annual meeting of the society is planned for next October 10–12 in Cincinnati. The directors also voted unanimously to accept an invitation to join the American Standards Association.

The three-day program of technical meetings was attended by more than 650 members and guests. "Economics of Tooling" was the subject of the opening symposium on Thursday afternoon, and served as the general theme around which succeeding sessions were planned. B. G. Tang, general superintendent, Schenectady Works, General Electric Co., introduced the symposium subject by discussing the importance of proper production planning.

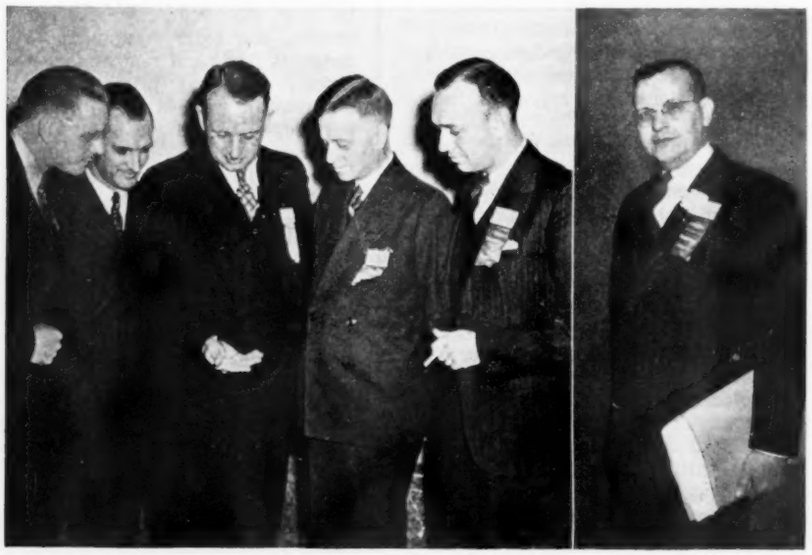
Pointing out that his plant must produce accurate small gears of 30 to 125 diametral pitch with 15 to 360 teeth, Tom Turner, Meter Div. Manager, Westinghouse Electric & Mfg. Co., told those attending a discussion of precision small gears that they are checking cutter shapes under 200-to-1 magnification, and using a magnification of 100-to-1 for inspecting gear tooth profiles. Until recently most such small gears have been produced on foreign-made equipment, but the troubles now experienced in obtaining machines and parts from abroad have brought about an increasing demand for American-made gear cutters suitable for small-diameter, fine-pitch gears. George H. Sanborn of Fellows Gear Shaper Co. and S. M. Ransome of Barber-Colman Co. discussed the features of new gear shapers and hobbers made available to meet this need.

Design Changes Considered

Cooperation between part and tool designers has done much in recent years to broaden the range of press operations and reduce their cost, said W. T. Forde, manufacturing supervisor, International Business Machines Corporation, in discussing punches and dies Friday morning. He pointed out that "improper part design may greatly reduce manufacturing efficiency and often results in unnecessary operations." Mr. Forde predicted increasing use of punches and dies in the production of small parts. Better tool design even now is making their use economical for small-lot production.

Gordon L. Reed, chief engineer, York Corrugating Company, took up the problems involved in the design and production of press tools used

Taking part *in the screw machine tooling symposium were, from left, Harold P. Berry, senior tool and gage designer naval gun factory; N. W. Taylor, foreman automatic screw machine department Wright Aeronautical Corp.; John R. Lynch, Ingersoll-Rand Co.; C. C. Stevens, mechanical superintendent New Departure Div., General Motors Corp.; and L. B. Gilbert, manager time and methods department, Columbus-McKinnon Chain Corp. E. W. Dickett, right, proposal engineer Sundstrand Machine Tool Co., was elected A.S.T.E. first vice-president*



in the manufacture of large auto body parts on a jobbing basis. He used a one-quarter scale model of a punch and die for drawing the fender for a modern automobile in illustrating a rapid method for determining die lines for such parts. Mr. Reed pointed out that tool cost frequently must be a minor consideration in determining the most economical production set-up for making job-lots of large sheet metal parts. Here, the number of presses to be used often is a determining cost factor and so must be kept at a minimum. His closing remarks are well worth remembering: "There is no rule of thumb which permits the tool engineer to make a snap judgment on the most economical operation lineup required for a given job. It is necessary that he be in command of full information pertaining to the quantity and quality of production of the stampings required, that he have a full knowledge of shop conditions and costs in his plant, and that he be informed of delivery and rate of production. This means that there must be close cooperation between the sales, estimating, planning, tool room, production and engineering departments and the tool engineer."

Educational Problems Discussed

The symposium on tool engineering education included speakers from industry and educational institutions. Discussing industrial requirements in tool engineering education, Clifford S. Stilwell, executive vice-president, The Warner & Swasey Company, suggested that educators should give more attention to personality in selecting and grading students. "No other quality," said Mr. Stillwell, "is so important in any walk of life." He emphasized that in all departments of industry the highest type of leadership must be recruited. Dr. J. W. Barker, dean of the college of engineering, Columbia University, said that under existing conditions engineering education in colleges is and should be limited to that part of the engineer's training that can be covered by books, leaving to industry the task of carrying on this training by means of a specialized program providing practical experience in the student's chosen field.

More Young Men Needed

Retiring A.S.T.E. president James R. Weaver, in an address at the annual dinner, stated his belief that "unless industry becomes interested in a program to bring more young blood into its manufacturing establishments, business itself will deteriorate, because as men grow older their ideas become more conservative. As new and difficult problems arise, older men lean on past experience and tradition, and know for sure that certain things can't be done. But the aggressive young fellow never heard about these impossible things—so he does them." He remarked that "there cannot be anything basically wrong with the use of improved machinery when it has increased our national income by 30 billion dollars during the last three decades and has given us the highest standard of living of any country on the face of the earth."

At the symposium on cutting tools and materials, E. S. Chapman, general works manager, Plymouth Division, Chrysler Corporation, gave some interesting examples of major savings made possible through the keeping of complete records of tool performance. The high speed steel group of cutting tools and materials was discussed by L. C. Gorham, president, Gorham Tool Company, while W. G. Robbins, president, Carboloy Company, described the properties and applications of the carbides as cutting materials. Mr. Robbins said that modern machine tools have adequate capacity for the speeds and tool pressures required for proper application of carbide-tipped tools for metal cutting. He reported that users of such tools for general-purpose machining have averaged a reduction of about 25 percent in machining time and an increase of about 42 per cent in machining capacity without adding to capital investment for new equipment.

NEW A.S.T.E. OFFICERS

NEW YORK—New officers elected by the directors of the American Society of Tool Engineers at their March 7 meeting in New York City are: A. H. d'Arcambal, consulting metallurgist Pratt & Whitney Div. of Niles-Bement-Pond CCo., president; E. W. Dickett, proposal engineer Sundstrand Machine Tool Co., first vice-president; Eldred A. Rutzen, tool engineer Cutler-Hammer, Inc., second vice-president; Conrad O. Hersam, consulting engineer, secretary; and Frank R. Crone, chief tool designer Lincoln Motor Co., treasurer.

Time out *from the technical sessions was taken by L. D. Rigdon of Westinghouse and William K. Stamets of Pittsburgh to renew an acquaintance of long standing with Herbert D. Hall, left, annual meeting committee general chairman. The three-day program of technical meetings was attended by over 650 registered delegates*

Keynoter *at the "Economics of Tooling" symposium was B. G. ("Barney") Tang, general superintendent of the Schenectady works, General Electric Co.*

Providence Journal

Past Apprentices—*Clayton R. Burt, standing, president Pratt & Whitney Div. of Niles-Bement-Pond Co. and a Brown & Sharpe apprentice course graduate, was chief speaker at the B&S graduate apprentice reunion and dinner held March 2 in Providence. Henry Buker, right, B&S vice-president and sales manager and a '95 graduate apprentice himself, was toastmaster. Old timers included Frank H. Lord, left, who began his apprenticeship 61 years ago, and Chas. F. Northrup, a graduate of '84. Some 425 graduates attended the affair*

B & S Graduate Apprentices Hold Reunion and Dinner

PROVIDENCE—Four hundred and twenty-five men who at various times had graduated from the Brown & Sharpe apprentice system gathered for a reunion and dinner here on March 2. Graduates came from ten states and Canada. Clayton R. Burt, president Pratt & Whitney Division of the Niles-Bement-Pond Co. and a B. & S. graduate apprentice, was the chief speaker. Henry Buker, vice-president and sales manager of Brown & Sharpe and a '95 apprentice graduate, was the toastmaster.

Mr. Burt stressed the fact that many companies would not be able to survive another depression if the federal government insists upon their paying out large amounts of earnings instead of accumulating adequate reserves. He said that companies which maintain a progressive attitude, bringing out new and better products, and all the while showing courage and faith, will come out on top. He declared that government will never be successful in running business. He paid tribute to Brown & Sharpe's fine training of men, many graduates of the course now filling responsible positions in industry throughout the country.

Professor Harold E. Edgerton, Massachusetts Institute of Technology, demonstrated the stroboscope and high-speed motion picture camera. J. E. Goff, supervisor of apprentices, welcomed former apprentices to the dinner. A letter was read from Henry D. Sharpe, president and treasurer of the company, expressing his regret because he could not be present.

Brown & Sharpe has just published a book listing the names of its apprentice graduates from the earliest class up to March, 1940. The company will send a copy to anyone interested upon request.

NAMES in the NEWS

W. E. BAKER, vice-president in charge of production of Servel, Inc., Evansville, Ind., mechanical refrigerator manufacturer, has been elected president of the Evansville Employers & Manufacturers Association.

WARREN J. BELCHER, in charge of engineering for the Whitney Chain & Mfg. Co., Hartford, Conn., has been elected a vice-president. RICHARD L. MULLANEY has been named assistant general manager.

H. A. BUMBY, vice-president and treasurer, has been elected president of Barlow & Seelig, Ripon, Wis., manufacturer of washers and ironers, succeeding R. I. PETRIE. R. C. LABISKY has been named assistant to the president.

E. C. CRITTENDEN, chief of the Electrical Division, National Bureau of Standards, has been elected president of the United States National Committee of the International Electrotechnical Commission. He succeeds DR. C. H. SHARP, who has been named honorary president.

H. A. FELDBUSH, formerly general manager of the Carbondale Division of Worthington Pump & Machinery Corp., Harrison, N. J., has been elected a vice-president. He will make his headquarters in Holyoke, Mass., having charge of operations of the corporation's Holyoke works, which manufactures air-conditioning and refrigeration equipment.

GEORGE E. FORD has been appointed manager of Fairbanks Valve Co., Binghamton, N. Y., succeeding E. F. RYAN.

NEWTON B. GREEN, since January, 1939, assistant manager of the Camera works of Eastman Kodak Company, Rochester, N. Y., has been named plant manager of that works. WILLIAM T. ROACH, since June, 1938, assistant manager in charge of the company's Hawk-Eye works, has been appointed plant manager of that works.

JOHN E. HARRIS, for the past five years assistant superintendent of the International Harvester Co. Chicago tractor works, has been named superintendent of the concern's Milwaukee works. He succeeds E. J. LEISER, who is retiring after 35 years of service.

J. C. MERWIN, former works manager and later vice-president of Chain Belt Co., Milwaukee, Wis., has been elected to the office of treasurer in addition to that of vice-president. L. C. MCKNIGHT, since 1933 sales manager of the company's Conveyor Division, has been named assistant to the vice-president.

LUIS DE OLAZARRA has been placed in charge of the new adding and calculating machine division of Shipman-Werd Mfg. Co., Chicago, Ill.

R. W. SORENSEN, professor of electrical engineering and head of the Department of Electrical Engineering, California Institute of Technology, Pasadena, Calif., has been nominated for the presidency of the American Institute of Electrical Engineers. Those nominated for vice-presidents include EVERETT S. LEE, General Electric Co., Schenectady, N. Y.; K. L. HANSEN, Harnischfeger Corp., Milwaukee, Wis.; and J. L. HAMILTON, Century Electric Co., St. Louis, Mo. T. F. BARTON, General Electric Co., New York, N. Y., and R. G. WARNER, United Illuminating Co., New Haven, Conn., have been nominated directors.

NORMAN W. STORER, retired consulting railway engineer, Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.,

has been awarded the 1939 Lamme Medal of the American Institute of Electrical Engineers "for pioneering development and application of equipment for electrical traction."

LOUIS W. YOUNG, treasurer of the Stanley Works, New Britain, Conn., and RICHARD E. PRITCHARD, a vice-president of the same company, have been elected directors of Hart & Cooley Co., New Britain, succeeding GEORGE HART and EDWARD N. STANLEY, resigned.

H. WARD ZIMMER, manufacturing manager of the Hygrade Radio Tube Division of Hygrade Sylvania Corp., Salem, Mass., and FRANK J. HEALY, general manager of the Hygrade Lamp Division, have been elected directors.

SALES

E. K. ANDERSON has been appointed manager of the Dallas, Texas, branch office of Cutler-Hammer, Inc., Milwaukee, Wis.

WILLIAM R. BOWER has been appointed Pittsburgh representative for Hill Clutch Machine & Foundry Co., Cleveland, Ohio.

CHARLES M. CHAPMAN has been appointed Cincinnati representative for the line of combustion control equipment made by the Hays Corp., Michigan City, Ind.

H. C. GROSSMAN, formerly connected with the Vonnegut Hardware Co., Indianapolis, Ind., has been named sales engineer for National Twist Drill & Tool Co., Detroit, Mich.

W. L. KENNICOTT, Los Angeles, Calif., has been named southern California representative for McKenna Metals Co., Latrobe, Pa.

ARTHUR G. LAMBERT has been appointed manager of the Export Division, Atlas Steels, Ltd., Welland, Ont. JOHN C. DAWSON has been appointed assistant manager of the division.

ROLAND McCUNE and JOHN B. MERIFIELD have been appointed southwestern and northwestern district sales managers respectively for the Wm. Schollhorn Co., New Haven, Conn.

L. B. McKNIGHT, sales manager of the Conveyor Division of Chain-Belt Co., Milwaukee, Wis., has been named assistant to the president.

DAVID K. MILLER has been appointed manager of the Baltimore branch of the Crucible Steel Co. of America. Since 1937 Mr. Miller has been district representative at Baltimore until its recent designation as a branch office. J. S. BILLINGSLEY has been appointed assistant manager of the company's Pittsburgh branch, while GEORGE SHARPE, formerly associated with Michigan Tool Co., has joined Crucible Steel, specializing in sales and promotion of Rexalloy.

Tool Show Crowded—*Sponsored by the Bridgeport Tool Engineers Association, the Industrial Tools & Equipment Exhibition held March 6–9 in Bridgeport, Conn., drew a heavy attendance. Including displays by 153 manufacturers and distributors, the show was opened officially by Gov. Raymond E. Baldwin, who stressed the importance of private enterprise as a means of giving employment. In the Governor's party were, from left, show manager R. T. Phipps, Gov. Baldwin, Col. R. Y. Moore, Benjamin A. Page, and A. V. Bodine*

W. B. MOORE, associated for some twenty years with Timken Roller Bearing Co., Canton, Ohio, has been appointed director of sales of the Steel & Tube Division. Formerly manager of industrial sales, Mr. Moore will be succeeded by S. C. PARTRIDGE, associated with the company since 1921.

M. E. O'BRIEN, manager of carbon steel bars and billets sales for Inland Steel Co., Chicago, Ill., has been made an assistant vice-president. BENTON J. WILLNER, since 1936 assistant manager of sheet and strip sales, has been made assistant vice-president and manager of the Sheet & Strip Division.

WILLIAM H. RICHARDSON has been appointed assistant general sales manager, Timken Roller Bearing Co., Canton, Ohio, a new position created because of increased activity in the company's industrial bearing section. Mr. Richardson is succeeded as general manager of the Sales-Service Div. by E. H. AUSTIN. R. P. PROFFITT has been named Chicago district manager.

CHARLES E. WILSON, since 1934 vice-president in charge of Pacific Coast operations for the Worthington Pump & Machinery Corp., is moving his headquarters to the company's home office in Harrison, N. J. He will direct sales of all products handled by the corporation's Carbondale Division, which specializes in air-conditioning and refrigeration equipment.

BUSINESS ITEMS

Elkhart Screw Products, Inc., has been formed in Elkhart, Ind., for the manufacture of machine tools. The corporation has 1,000 shares of no-par capital stock. Incorporators are HAROLD ANDERSON, HUGO HAVLISH and C. WHITNEY SLABAUGH.

Hoyt Screw Machine Products Co., South Bend, Ind., is moving to Mishawaka, Ind., as soon as its new building there is completed.

Charles L. Jarvis Co., Middletown, Conn., power appliance manufacturer, has established a branch office at 1344 W. Washington Blvd., Chicago, Ill. G. V. RAMSTACK is in charge.

Meta-Mold Aluminum Co. has moved to 95–105 Hamilton St., Cedarburg, Wis.

M.E.M.A. Light & Signal Group has changed its name to Safety Equipment Manufacturers Association and

has moved to 350 Madison Ave., New York, N. Y.

Stinson Aircraft Div. of Aviation Mfg. Corp. is moving from Wayne, Mich., to Nashville, Tenn. Some 200 employees, including most of the engineering and sales staffs, will be transferred. Move will be completed about April 1.

Whitlock Coil Pipe Co., Hartford, Conn., has changed its name to Whitlock Mfg. Co. in view of its increasingly diversified line of heat-exchange devices.

PLANT EXPANSION

George H. Alexander Machinery, Ltd., Birmingham, England, licensed in 1938 by McKenna Metals Co., Latrobe, Pa., to sell "Kennametal" tools throughout the British Empire, is erecting two plants in Great Britain for the fabrication of "Kennametal" tools.

Allegheny Ludlum Steel Corp. is planning a $300,000 addition to the wire milling department of its Dunkirk, N. Y., works.

Cummins Engine Co., Columbus, Ind., is building a $200,000 research and testing laboratory. Claimed to be the most modern in the country, the building will contain 10,600 sq.ft. of floor space.

Herbert Corp. has been organized in Chicago, Ill., for the manufacture of automatic phonographs. The company has leased 30,000 sq.ft. of floor space at 3125 W. Chicago Ave., where production will begin early in April. The company, headed by HERBERT C. JOHNSON, is a subsidiary of National Die Casting Co., Chicago, which will provide the die castings required.

International Harvester Co., Chicago, Ill., is building a 15-acre addition to its plant in East Moline, Ill. Structure, which is planned to be completed in time for the auto manufacturing season, will be used in making a new 4-ft. combine and in facilitating production of other agricultural implements.

The Engineering & Construction Div. of Koppers Co., Pittsburgh, Pa., has opened a branch in Tulsa, Okla., to serve the oil and gas industries. W. A. LEECH, JR., is in charge.

Nash-Kelvinator Corp. is planning erection of a new machine shop at its Kenosha, Wis., plant.

Square D Co., Milwaukee, Wis., has awarded contract to the Austin Co., Cleveland, for design and construction of a 238x430-ft. plant and office building.

OBITUARIES

PAUL C. SAUERBREY, vice-president and general manager of the Plymouth Div. of Chrysler Corp., died March 4 in Fort Lauderdale, Fla., following an extended illness. He was 60 years of age.

A native of New York City, Mr. Sauerbrey joined Mergenthaler Linotype Co. as an apprentice, after

PAUL C. SAUERBREY

which he became a journeyman mechanic in the railroad business. His first employ in the automotive industry was with the Timken Axle Co. in Detroit. He subsequently became manager of the Muncie Products plant in Muncie, Ind. In 1926 he joined Chrysler Corp. as a member of the staff of K. T. KELLER, now president. His principal duties lay in organizing the Plymouth Div., and in 1929 he was made vice-president in charge of manufacturing of that division, with which he remained until his death.

DEWITT PAGE, former president and general manager of New Departure Div. of General Motors Corp. and a director and vice-president of General Motors, died Feb. 28 at Miami, Fla., following a heart attack. He was 70 years of age.

HUTTON H. HALEY, 53, Detroit district sales representative for American Foundry Equipment Co., Mishawaka, Ind., died March 1.

HERBERT M. NELSON, 82, member of Nelson Bros. & Strom, Inc., Racine, Wis., makers of tools, dies and jigs, died March 3 in that city.

FRANKLIN A. NOTT, 83, former plant superintendent for Peck, Stowe & Wilcox, East Berlin, Conn., died March 10.

HENRY C. MILLIGAN, 87, chairman of Republic Stamping & Enameling Co., Canton, Ohio, and founder of the Newark Stamping Co., Newark, N. J., died in Canton March 8.

M. STEWART DRAVO, 56, manager of the Pittsburgh office of Crucible Steel Co. of America, New York, N. Y., died Feb. 20.

JOHN H. SULLIVAN, 68, president Sullivan-Becker Machine Co., Kenosha, Wis., and organizer of the company, died March 4 at a hospital in that city.

CHARLES ARTHUR WHITE, 58, secretary-treasurer Leeds & Northrup Co., Philadelphia, Pa., died March 2 at a hospital in that city following a brief illness.

CHARLES W. TYACKE, 60, president Everett Iron Works, Everett, Mass., died March 1 at his home in Lynnfield Center, Mass.

FRANK A. WATSON, 48, chief plant engineer Stewart-Warner Corp., Chicago, Ill., died March 4 at a hospital in that city.

MEETINGS

AMERICAN GEAR MANUFACTURERS ASSOCIATION. Annual convention, Grove Park Inn, Asheville, N. C., May 20–22.

AMERICAN IRON & STEEL INSTITUTE. Forty-ninth general meeting, Hotel Waldorf-Astoria, New York, N. Y., May 23.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Spring meeting, Hotel Bancroft, Worcester, Mass., May 1–3.

AMERICAN SOCIETY FOR TESTING MATERIALS. Annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 24–28.

ASSOCIATED MACHINE TOOL DEALERS OF AMERICA. Spring convention, Claridge Hotel, Atlantic City, N. J., May 13 and 14.

INTERNATIONAL ACETYLENE ASSOCIATION. Fortieth convention, Schroeder Hotel, Milwaukee, Wis., April 10–12.

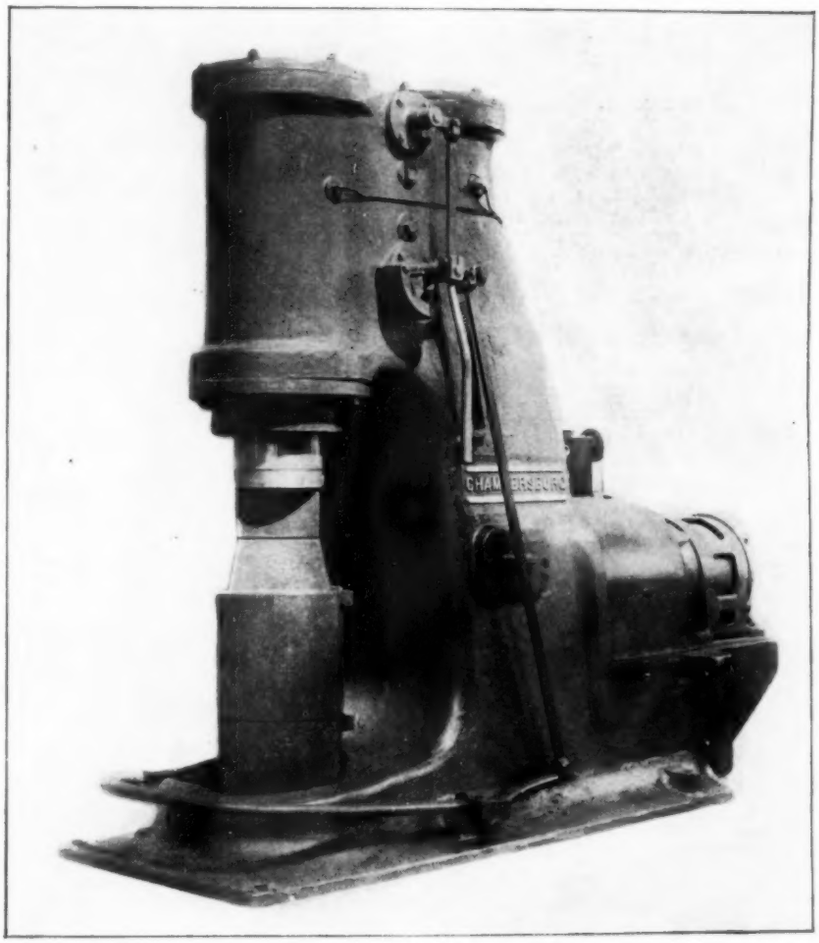
MACHINE TOOL ELECTRIFICATION FORUM, East Pittsburgh, Pa., works of Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., May 6–8.

PACKAGING INSTITUTE. Machinery division meeting, Hotel Astor, New York, N. Y., March 25.

SOCIETY OF AUTOMOTIVE ENGINEERS. National transportation and maintenance meeting, Mellon Institute auditorium, Pittsburgh, Pa., March 28 and 29. Summer meeting, The Greenbrier, White Sulphur Springs, W. Va., June 9–14.

SHOP EQUIPMENT NEWS

Chambersburg Electro-Pneumatic Hammers Economically Forge Tough Alloy Steels



Among the advantages claimed for the self-contained electro-pneumatic hammers offered by Chambersburg Engineering Co., Inc., Chambersburg, Pa., is that more actual forging per blow is accomplished because of the heavier angle construction and the higher impact speeds possible with these hammers. The rapidity of the blows permits working the blows at higher temperatures. Operating economies are secured by the use of anti-friction bearings, by the elimination of parts, and by the low center-of-gravity construction which insures freedom from wear as well as more stable operations. Long ram guides, close to the working zone, protect the hammer cylinder against damage from off-center blows.

These pneumatic hammers have a compression piston cylinder and a ram cylinder. In operation the ram is driven up and down by a flexible air force created by the compressor piston. This piston is driven by a high-speed electric motor through two-stage reduction gearing. The hammer can be started instantly and strikes a constant number of heavy or light blows at the will of the operator. As soon as the motor is up to speed the hammer is ready to operate. "Squeeze" or hold-down is provided by a setting of the operating lever latch.

These pneumatic hammers are made in three types: (1) one piece having the anvil integral with the frame for installations where deep foundations are impractical, these hammers are rated at 200 and 300 lb.; (2) solid frame, having separate anvils and a one-piece frame of reinforced construction, made in sizes up to and including 500 lb.; (3) two piece frame having separate anvils, with the frame mounted on a base plate which encircles the anvil, sizes 750 lb. and upward are so made.

Denison Vertical Presses Have Hand and Foot Controls

Type DLSC-1 vertical hydraulic presses made by the Denison Engineering Co., 236 N. Water St., Columbus, Ohio, are designed for straightening, forcing and general production pressing operations. Two sizes are available, with working capacities of 25 and 50 tons, respectively. Maximum stroke is 18 in. for both sizes. Other specifications are: maximum vertical opening, 30 in.; depth of throat from center line of piston, 10 in.; rest plate size for standard presses, 18 x 60 in.

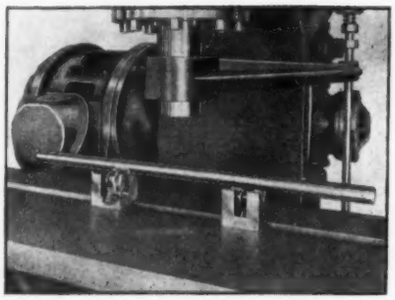
These hydraulic presses may be operated either by a conveniently located hand lever or by a foot pedal. The pump motor is controlled by a pushbutton located near the throat of the press. Controls are so arranged that with the pump and motor running and the hand lever and foot pedal in normal unoperated position, the press ram is raised and the pump

and motor are running idle. Operating the pedal or lever causes the ram to move downward at rapid traverse speed until contacting the work. After the work is contacted, further movement of either the hand lever or

foot pedal causes greater tonnage to be applied by the ram. Upon release of the lever or pedal the ram raises to its "up" position as determined by the adjustment on the stroke control rod.

Greenerd Straightening Blocks Permit Higher Production

A line of combination test rolls and straightening blocks, designed to speed up straightening of round shafts either turned or ground, has been made available by Greenerd Arbor Press Co., P. O. Box 415, Nashua, N. H. The shaft, when placed on these blocks, is suspended between two sets of hardened rolls, enabling the operator to spin it to locate the high spots. Then, without removing the work from the blocks, pressure of the arbor press is applied.



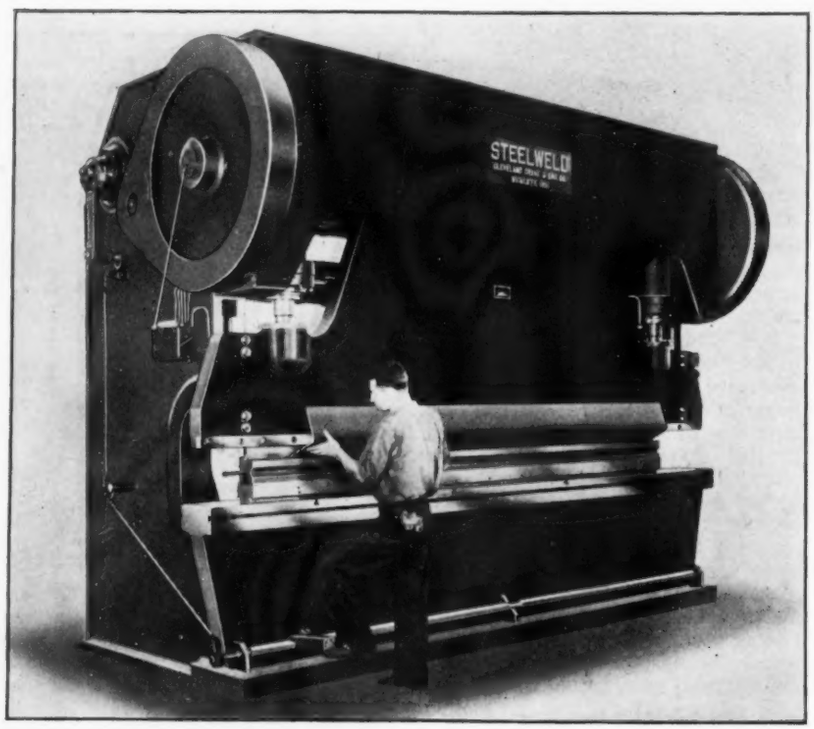
This pressure causes the rolls to recede, while the work falls into the two steel vees for straightening. When the pressure is released, springs in the blocks lift the rolls to their original positions again centralizing stops. Blocks are furnished for straightening shafts of ½–1, 1–2, and 2–3 in. in diameter, respectively.

Steelweld Welded Frame Press Brake Handles Plate 12-Ft. Long Between Housings

The Steelweld Machinery Div., Cleveland Crane & Engineering Co., Wickliffe, Ohio, has announced the addition of the Model J-12 to their line of Steelweld press brakes. This press will handle plate to 144 x ½ in. between housings and up to 14 ft. over the total length of the bed and ram. Longer plate can be handled by extending the bed and ram either on one or both ends. The press shown has a double end extension. Like other Steelweld presses, the Model J-12 machine has a one-piece all-welded frame.

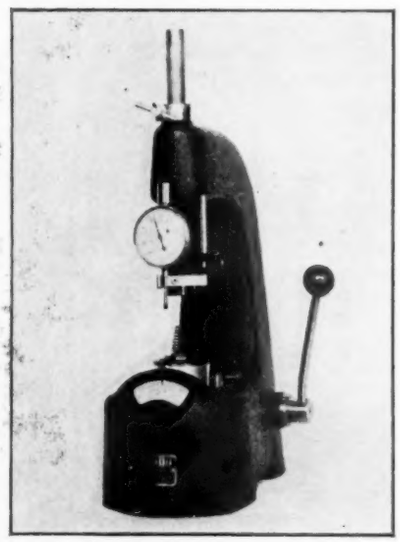
The ram of this press brake is operated by two eccentrics, one on each side of the machine. Each eccentric is provided with three large main bearings and an eccentric bearing. Bearings are lubricated automatically by two oiling units mounted on either end of the machine. All gears are protected with metal covers and shafts are located at the rear of the machine away from possible damage by crane hooks and bent-up plates.

The press may be used for bending, forming, blanking, drawing, rubber-forming and multiple-punching operations. Several operations may be handled by passing the work successively through various dies set in position along the length of the machine. Approximate over-all dimensions are: length, 186 in.; depth, 88 in.; height, 132 in.; depth of throat, 18 in.



Link PB3 Spring Checker Tests Compression Springs

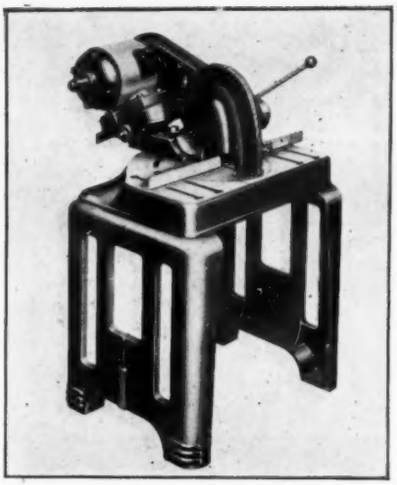
A rapid and accurate method of testing compression springs is provided by the No. PB3 spring checker offered by Link Engineering & Mfg. Co., 1054 W. Baltimore Ave., Detroit, Mich. Other applications for this unit include tests for load required to operate valves, firing pin assemblies and



similar units. The standard model handles springs up to 6 in. free height and 2⅝ in. diameter in 10–50–250 lb. capacity. It is provided with a 6 in. vertical height scale graduated to 1/32 in. for indication of compressed height. The unit shown has a special 1 in. travel reverse-reading dial indicator fitted in an adjustable ram bracket to allow maximum range of 4 in. The dial indicator is adapted to the checking of springs with close height tolerances.

Delta Abrasive Cut-Off Unit Has 2-in. Diameter Capacity

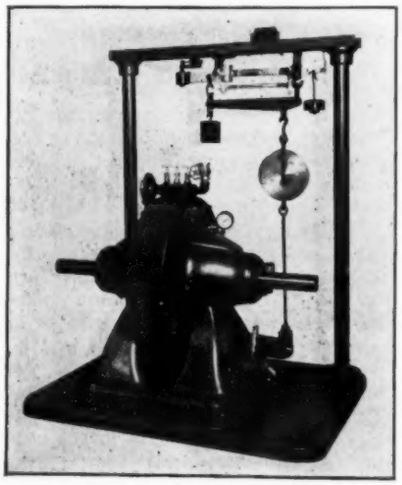
The Delta Mfg. Co., 620 E. Vienna Ave., Milwaukee, Wis., is offering this improved abrasive cut-off machine for cutting such materials as steel, brass, copper, cast iron, monel metal, bakelite and other plastic materials, pipe, wire rope, fibrous material, porcelain and hard rubber to exact lengths. By switching to a saw blade this unit can be used for cutting



wood. It has a capacity up to 2 in. diameter, or material up to 2 x 6 in. Outstanding features include wide-spaced Timken roller pivot bearings and double arbor bearings which require no lubrication, V-belt drive, adjustable fence, and an accurately machined table. The head is balanced and will cut at any angle.

Taylor Announces Improved Hydraulic Dynamometers

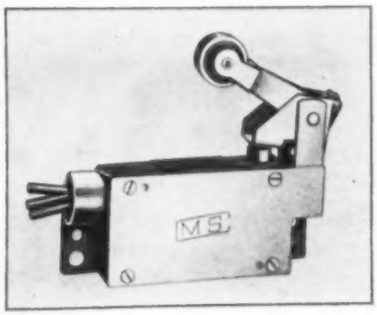
Improved "Hi-Eff" hydraulic absorption dynamometers offered by Taylor Sales Co., 2330 W. Clybourn St., Milwaukee, Wis., exclusive distributors of products of Taylor Mfg. Corp., are available in a wide range of sizes, to 10,000 hp. and 25,000 r.p.m., suitable for both high speed—low torque and low speed—high torque testing of



prime movers. Heavy-duty construction, over-size ball bearings and precision balanced rotors are claimed to assure long life and dependable testing data. Accuracy of the Taylor dynamometer is said to be 99.7 per cent. Speed, load, lubrication and packing adjustments are accomplished readily while the dynamometer is in operation. The combination of peripheral and side-wall vanes in both the stator and the rotor, result in high capacity within a comparatively small machine.

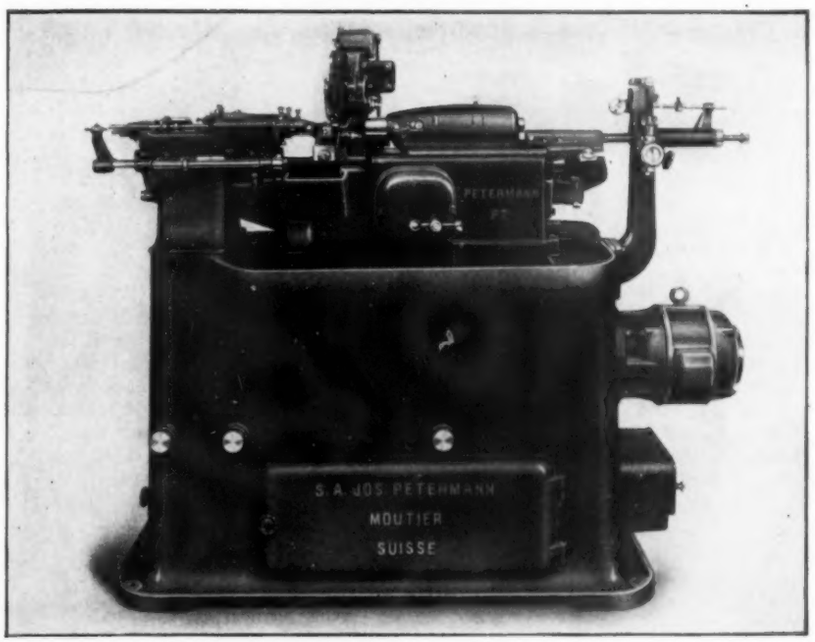
"Micro" Precision Switch Actuated by Cams

The No. LK-2 precision limit switch announced by The Micro Switch Corp., Freeport, Ill., is designed for actuation by rotating or sliding cams. The roller lever is adjustable through an arc of 225 deg. Switching element contained in the steel housing is a single-pole "Micro" switch with normally open, normally closed, double throw contact arrangements. This limit switch has a movement differential at the roller of 0.002 in., a pretravel of 1 deg., an overtravel of 20 deg., and requires an operating pressure of less than 1.8 lb. Interchangeability is possible because the operating point is held within plus or minus 0.002 in. with relation to



mounting dowels. It is resistant to oil and water and is said to have a life of more than a million operations. This switch is rated at ½ hp. up to 460 volts a.c.

Petermann Automatic Screw Machine Features Tools Close to Work Support



Sold in the United States by Russell, Holbrook & Henderson, Inc., 99 Hudson St., New York, N. Y., the Swiss-made Petermann Model P7 automatic screw machine has a nominal capacity of 0.280 in. through the spindle. With an enlarged spindle this capacity is 0.360 in. The distinguishing feature of this machine lies in the fact that the headstock is provided with a working feed and the work is fed by the headstock through a revolving or stationary bushing. The five slide tools are always working directly at or only a few thousandths of an inch away from this point of support. This is claimed to result in diametrical accuracy of a high order.

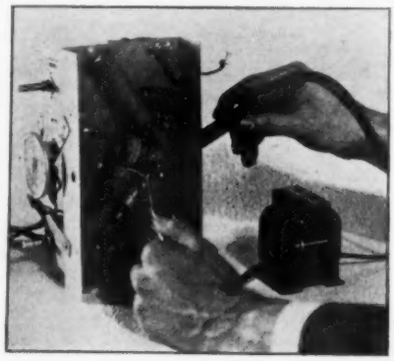
The five tool slides are successively brought into the work by the action of cams in coordination with the lead or headstock feed cam, thus generating a form with easily ground tools. The possibility of changing the ratio between the cam rises and the tool point independently makes it possible in many cases to vary the form without altering the cams or tools. These tools are adjustable micromatically in three directions.

Seventeen changes of speed are obtainable by means of pick-off gears. For each spindle speed there are 58

camshaft speeds. The standard machine has a spindle speed range of 1,800 to 10,000 r.p.m. The slow-speed machine of the same size has a speed range of 1,200 to 7,000 r.p.m. Interchangeable attachments are available for centering, drilling and threading, screw-head slotting, cross hole drilling, and similar operations. Threading is done by overrunning, that is by driving the tap or die in the same direction as the work but faster, making the stopping and reversing of the work spindle unnecessary.

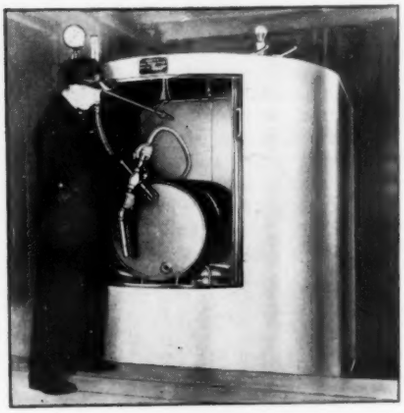
Ideal Electric Solderer Developed for Instrument Work

Recommended for all types of light soldering, like that in instrument assembly, the "Instant Heat" electric solderer offered by the Ideal Commutator Dresser Co., 1057 Park Ave., Sycamore, Ill., heats instantly upon touching the wire or terminal to be soldered. Only slightly larger than a lead pencil, this tool easily reaches hard-to-get-at places. Heating stops upon taking the carbon away from the wire. It can be laid down without fear of scorching any article it touches. Line current is reduced by a transformer to a harmless low voltage, so that there is no danger from shock or burns. Current is used only when in actual contact with the work. Power consumption is approximately 80 watts.



Portland Drum Reconditioner Has Automatic Cleaning Cycle

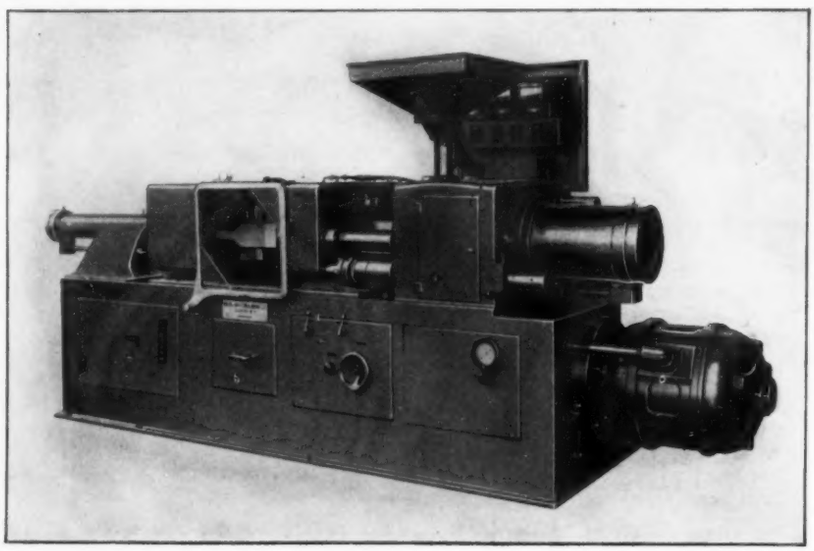
The "Portco" oil-drum reconditioner developed by the Portland Co., Portland, Me., automatically cleans and dries both the inside and outside of an oil drum in one continuous operation. Consisting primarily of motor-driven turntable and pumps, suitable spray and siphon units and tanks, all inclosed in a metal cabinet, this unit is equipped with General Electric motors and controls. In operation, the drums are placed on the turntable, a combination pressure and siphon nozzle inserted in the opening in the drum, and the cabinet door is closed. Closing the door starts an automatically controlled cycle during which the machine successively forces into and over the drum, a caustic solution, rinse water and air for drying, simultaneously siphoning all liquid from the drums. On completion of the cycle, the control de-energizes.



Watson-Stillman Hydraulic Injection Molder Provides Greater Plasticizing Capacity

An important feature of the No. 8-A hydraulic injection molding machine, announced by the Watson-Stillman Co., Roselle, N. J., is zone heat control which provides distributed head, giving a greater plasticizing capacity to the heating cylinder. The smooth, uniform bore of the cylinder offers no place for the material to lodge and facilitates the changing from one color to another. The 24-in. maximum opening between die plates, with 18 in. adjustment on the clamping end, allows for the accommodation of dies 6 in. thick and up. The toggle-clamping device affords positive clamping of dies having up to 125 sq. in. projected area so large castings can be made.

Two material cylinders are available for use with this machine. The maximum weight of material injected per cycle with the $2\frac{3}{16}$ in. cylinder is 6 oz. at a pressure of 50,000 lb. per sq. in. With the $2\frac{3}{4}$ in. cylinder, the maximum weight is 8 oz. at a pressure of 32,000 lb. per sq. in. Stroke of the injection plunger is 9 in. and speed of this plunger is 150 in. per min. The molder is arranged for full-automatic, automatic single cycle, and manual control. Working pressure is 2,050 lb. per sq. in. The machine occupies a floor space of 196 x 45 in.

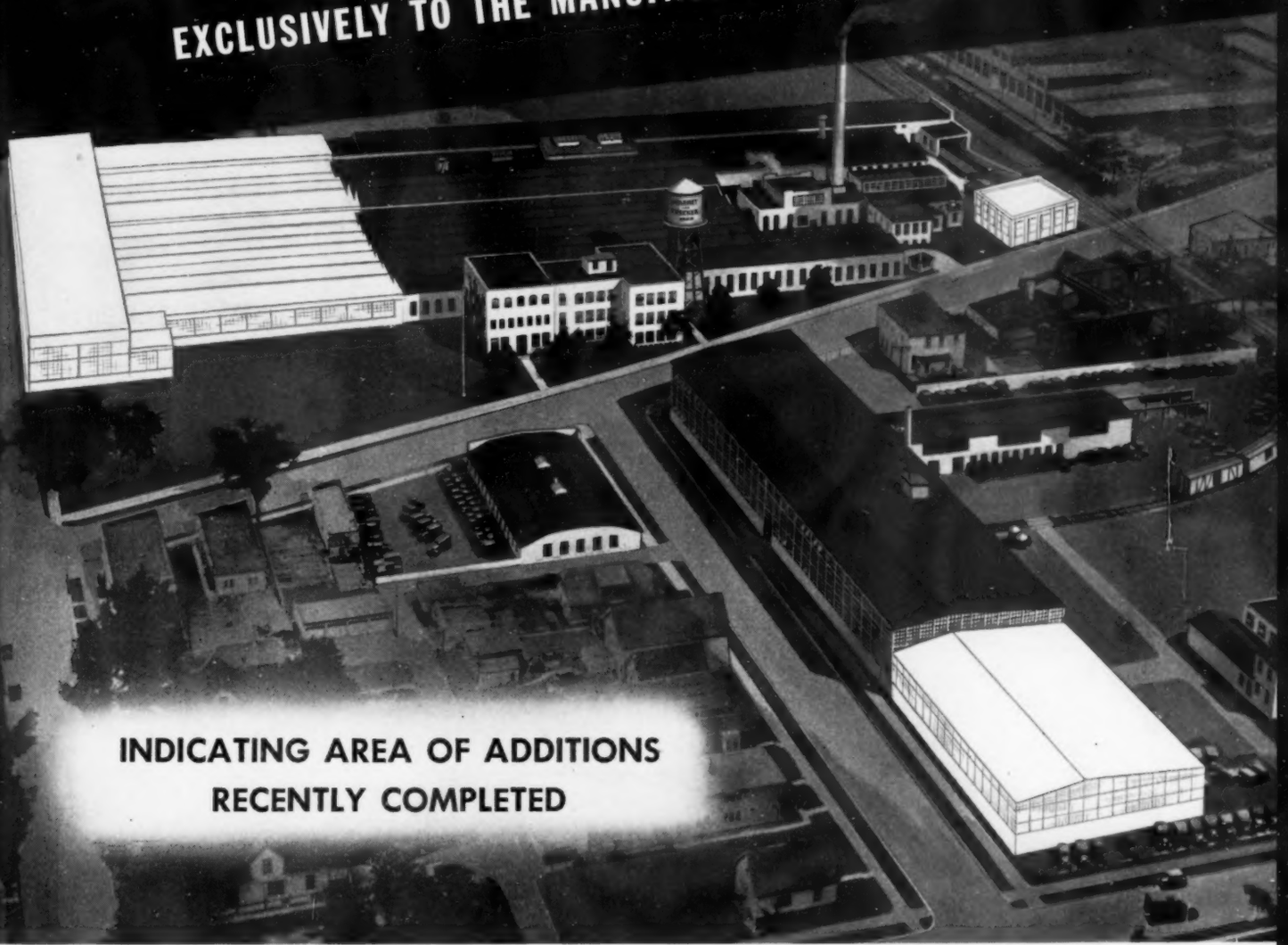


Kickless Welding Cable Connects Gun to Transformer

A water-cooled electrical connection between the secondary taps of a welder transformer and a portable welder gun, the kickless cable announced by Clark Controller Co., 1146 E. 152nd St., Cleveland, Ohio, consists of a central soft rubber core around which six flexible copper cables are wound helically. For alternate polarity these cables are separated by a corrugated live rubber spacer, the whole inclosed in a flexible, specially made, cord-reinforced rubber tube. This construction permits free circulation of cooling water in direct contact with the stranded copper cable and provides utmost flexibility. It is claimed that the construction of this cable permits the passage of about 50 per cent more welding current than now is passed by separate welder cables of comparable size. With two separate cables, the high reactance causes the cables to jerk or "kick" away from each other. With this cable, the interweaving of cables of

Now Being Equipped--

THE LARGEST PLANT IN THE WORLD . . . DEVOTED EXCLUSIVELY TO THE MANUFACTURE OF MILLING MACHINES



INDICATING AREA OF ADDITIONS RECENTLY COMPLETED

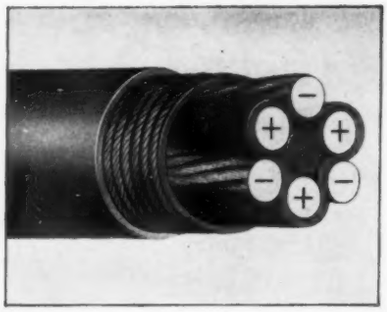
IN response to a continuing and unprecedented demand for Milwaukee Milling Machines, the Kearney & Trecker plant is now being expanded with every modern facility to enable us to increase our production and maintain the standards which have won world-wide recognition for the advanced design and construction of Milwaukee Milling Machines.

KEARNEY & TRECKER CORPORATION, Milwaukee, Wisconsin, U.S.A.

MORE THAN *41 years* OF DOING ONE THING WELL

K&T

Milwaukee MILLING MACHINES



opposite polarity with the corrugated rubber spacer causes the reactances to neutralize each other, thus eliminating the jerking. Normal city water pressure can be used successfully with this cable. At present this cable is furnished in only one size.

Dietzgen Pen-Filling Stand Made from Three Parts

The "Handy" pen-filling ink stand, announced the Eugene Deitzgen Co., 2425 Sheffield Ave., Chicago, Ill., consists of three parts: a stand which holds the regulation ¾ oz. bottle of ink; a dipper arm which closes the

bottle tightly when not in use, and a finger-touch lever which raises a filling loop on the end of the arm from the bottle. Designed for filling ruling pens, this stand is claimed to save considerable time and ink over the usual hand-filling method. A rubber stopper on the dipper arm seals the bottle against evaporation. The loop may be lowered or raised according to the level of ink or to the amount of deposit desired.

Hexacon Soldering Irons Are of Constant-Duty Type

Three additional sizes have been added by the Hexacon Electric Appliance Corp., 161 W. Clay Ave., Roselle Park, N. J., to their line of electric soldering irons. Built for constant-duty industrial use, these three additional soldering irons have 60, 120 and 170 watts capacity, respectively, with tips of ½, ⅝ and 1 in. diameter. The element is housed in a steel hexagon barrel which protects the element from mechanical injury. Because of its hexagon shape, the iron can be held in a vise when replacing or filing the tip without danger of damaging the element by denting the outer housing. These irons are equipped with a flexible cord covered with a twine braid.

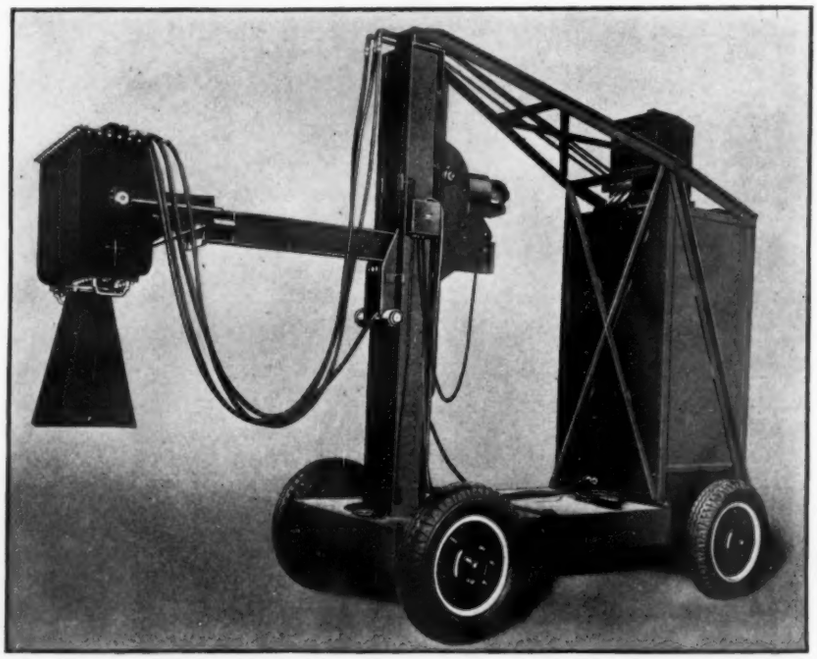
Bates Numbering Pliers Adjustable for Diameter

The number wheel used on the numbering pliers offered by H. O. Bates, 251-257 N. Broad St., Elizabeth, N. J., can be engraved to order with letters or figures from 1/32 to ¼ in. high. These pliers are adjustable to a variety of diameters and can be used successfully to mark steel, brass, plastics, fibre, wood and other materials in various shapes and sizes.

G. E. Industrial X-Ray Unit Permits Examination of Too-Big-To-Move Structures

Developed especially for use in foundries and welding shops for the X-ray examination of large units, the No. OX-220 mobile X-ray unit manufactured by General Electric X-Ray Corp., 2012 Jackson Blvd., Chicago, Ill., permits examination of 3-in. of rolled steel or 3½-in. of cast iron or steel on a production basis. Operation of the unit is free from the limiting effects of dust and humidity because its entire high-voltage system is mounted in a shock-proof oil-filled container. The tube head unit, which can be rotated 360 deg. around two axes at right angles to each other, can be positioned easily and accurately. The tube head is provided with a horizontal travel of 4 ft. and a vertical travel of 6 ft. All X-ray controls are housed in a lead-lined steel cab which provides complete protection for the operator.

The unit is mounted on a fabricated frame equipped with pneumatic tires, two-wheel brakes and a draw-bar. An interesting feature of the design of this unit is the fact that it is balanced so accurately that it can be picked up and moved from place to place by an overhead crane if necessary. This time-saving feature is of advantage when the unit is used in crowded shops where it would be an expensive and at times impossible procedure to keep aisles open for floor travel.



THREADING EQUIPMENT

Deliveries are rapidly becoming extended.

If your pipe, bolt or nipple threading machines are worn out—now is the time to replace them while deliveries are still within reason.

Ask your Machine Tool Dealer for complete information on the

OSTER-WILLIAMS LINE

OSTER THREADING EQUIPMENT WILLIAMS

THE OSTER MANUFACTURING CO.

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NEW MATERIALS

New Bethlehem Air-Hardening Die Steel Gives High Hardness With Mild Treatment

Essential advantages offered by a new air-hardening die steel developed by Bethlehem Steel Co., Bethlehem, Pa., are: (a) good hardenability when air quenched, comparable to many liquid quenched die steels; (b) low quenching temperature, 100 to 200 F. below that required for ordinary air-hardening die steels with equal hardness, thus simplifying furnace operation and minimizing distortion and danger of cracking; (c) satisfactory machinability in annealed condition; (d) high abrasion and wear resistance; (e) ease of heat-treatment; and (f) good hardness penetration.

This steel replaces steels requiring liquid quenching for developing the characteristics desired in dies, punches and similar tools. After extensive tests, the following approximate analysis was found to give the properties desired: carbon, 1.00 per cent; manganese, 2.00; chromium, 2.00; molybdenum, 1.00 per cent. Slow and uniform heating is important in forging, which preferably is carried out between 1,950 and 2,000 F. If a preheater is available, it is advantageous to hold the parts at 1,200 F. until thoroughly heated before they are brought to full temperature in the forging furnace. Forging temperature must not drop below 1,500 F.; if necessary the part should be reheated. Due to their air-hardening properties the forged parts should be cooled in lime, ashes, silocel or some other heat-retaining medium.

The annealing cycle prescribed has two purposes: to produce a steel with good machinability, and to develop a structure which will insure effective response to air hardening. A Brinell hardness under 229 on small and medium sized parts is developed by heating slowly and uniformly to 1,600 F., holding at that temperature for at least one hour per inch of average thickness, and cooling at a rate of 20 F. per hr., down to about 400 F. The parts then are reheated to 1,325 F. and held at this temperature for about four hours per inch of thickness. Finally they are removed from the furnace and cooled to room temperature.

An alternate annealing cycle may be used provided slightly higher hardness is not objectionable. This cycle consists of heating slowly to 1,400 F. and holding at that temperature for at least one hour per inch of thickness of the average dimensions. Cooling is carried out at a rate of 20 F. per hour to 900 F. followed by furnace cooling to room temperature.

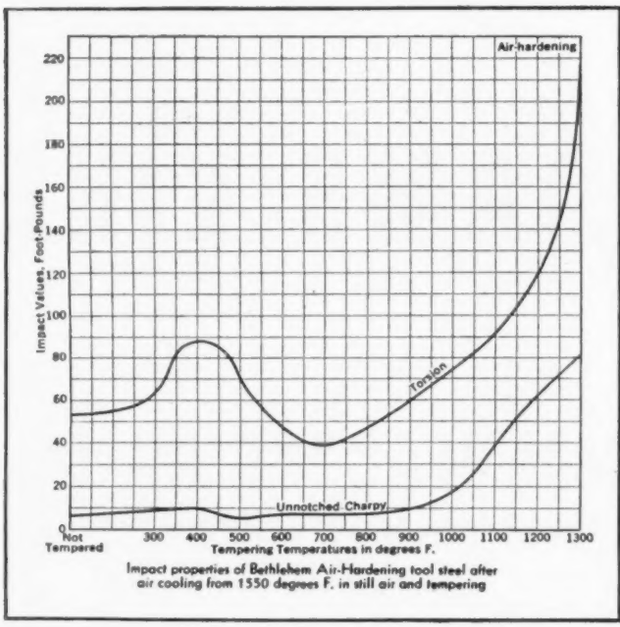
Care must be exercised in heating and quenching in order to keep distortion to a minimum, and to prevent decarburization. The steel should always be heated slowly to the hardening temperature. Pack hardening is advocated for large parts to insure maximum surface hardness. If possible, it is well to preheat to about 1,200 F. and soak thoroughly at that temperature. The recommended hardening temperature is 1,550 to 1,625 F., depending on the size of the piece. The pieces should be held at the hardening temperature for one hour per inch of average thickness. They then are air-cooled. For large dies an air blast should be directed against the face during hardening.

Parts are charged into the tempering furnace after cooling to about 200 F. Depending upon size and degree of hardness desired, the temperature then is slowly raised to between 325 and 375 F., where it is maintained for at least 1½ hr. per inch of average thickness. This is followed by slow cooling to room temperature.

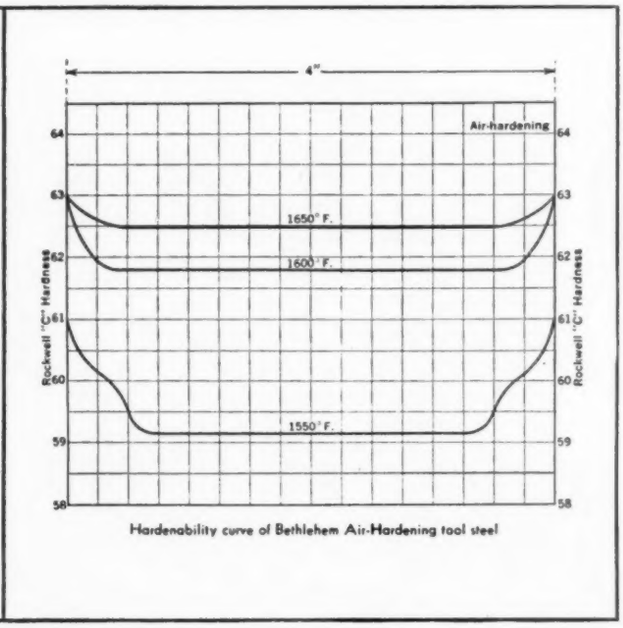
Dilatometric tests on 1 in. round specimens, heated and cooled at a rate of 400 F. per hr. gave the following ranges: (1) heating: Ac range, 1,370 to 1,440 F.; (2) cooling: Ar range, 1,300 to 580 F. Impact properties of this air-hardening tool steel after air cooling from 1,550 F. in still air and tempering are indicated on the accompanying chart. A second chart shows the hardenability curve of this steel.

"Sinterloy" Powder Pressed Then Sintered to Form Steel

A powder which may be pressed into any desired form by the accepted methods used in power metallurgy and which when sintered will result in a steel, "Sinterloy", offered by Charles Hardy, Inc., 415 Lexington Ave., New York, N. Y., may be obtained in three compositions for the production of steel having a carbon content of approximately 0.15, 0.40 and 0.80 per cent. In most cases "Sinterloy" may be pressed directly into the shape of the finished product so that machining costs and metal losses are eliminated. It is



Impact properties of Bethlehem Air-Hardening tool steel after air cooling from 1550 degrees F. in still air and tempering



Hardenability curve of Bethlehem Air-Hardening tool steel

recommended for use where difficult machining work is required and exact duplications of parts is desired. It is claimed to be showing excellent results on applications where wear resistance is an important factor. Sinterloy is suitable for products such as gears, cams, pump rotors, washers, pins and rivets. It is being used successfully for splines operating at high speed under alternating stresses where endurance to fatigue is of importance. Sinterloy may be hardened by heat-treatment to the accepted hardness usually experienced with steels of corresponding carbon content. It also may be pack-hardened like ordinary steels. Sinterloy fabricated parts properly treated are said to give a tensile strength of the same order as cast alloy steels. Sintering is done in a controlled atmosphere to prevent oxidation and decarburization. If maximum densities are desired the parts may be repressed after sintering. Hardening may be accomplished by heating to 1650 F. and oil quenching, followed by the usual tempering.

TRADE PUBLICATIONS

BELTING J. E. Rhoads & Son, 35 N. Sixth St., Philadelphia, Pa., has devised a handy pocket slide rule for calculating factors entering into all belting problems.

BUSHINGS Johnson Bronze Co., 906 S. Mill St., New Castle, Pa., has devised a slide-rule calculator which lists specifications of over 800 sizes of standard stock bronze bearings and bushings.

CLEANING A leaflet offered by Quigley Co., 56 W. 45th St., New York, N. Y., discusses uses of "Annite" cleanser.

DEMAND METERS Selection, operation and specifications of a line of demand meters are provided in a 16-page illustrated catalog, No. GEA-3226, published by General Electric Co., Schenectady, N. Y.

DEVELOPMENTS General Electric Co., Schenectady, N. Y., has published a fully illustrated 54-page booklet entitled "Electrical Developments of 1939". Prepared by Guy Bartlett, this booklet discusses developments in most of the fields served by the electrical industry.

DRILLING "Since 1872 . . ." a sixteen-page illustrated booklet compiled by the W. F. & John Barnes Co., Rockford, Ill., traces the history of the company and its products.

ELECTRICAL DEVICES Cole Radio Works, Caldwell, N. J., gives particulars of a "Life-Saver" portable waterproof transformer, "Instansolder"

ACCURATE! TO THE FIFTH DIMENSION!

1 LENGTH
2 CROSS SECTION
3 STRAIGHTNESS
4 SURFACE FINISH
5 METALLURGICAL UNIFORMITY

WYCKOFF
COLD DRAWN STEELS

Matching the super-efficiency of today's high speed automatics is the five-dimensional accuracy of Wyckoff Cold Drawn Steels.

Always quickly available in complete range of standard sizes from well-stocked warehouses in principal industrial centers, Wyckoff Cold Drawn Steel is your logical selection for year round satisfaction and performance.

WYCKOFF DRAWN STEEL COMPANY
FIRST NATIONAL BANK BLDG., PITTSBURGH, PA.
3200 SO. KEDZIE AVENUE · CHICAGO, ILL.
Mills at Ambridge, Pa. and Chicago, Ill. . . . Warehouse Stocks in Principal Cities . . . Manufacturers of Carbon and Alloy Steels . . . Leaded Steels . . . Turned and Polished Shafting . . . Turned and Ground Shafting . . . Wide Flats up to 12" x 2"

electric soldering outfit, "Hi-F" high-efficiency fully inclosed small transformers, and lighting units for machine tools, in a four-page illustrated folder.

GEAR MAKING Cross Gear & Machine Co., 3250 Bellevue Ave., Detroit, Mich., describes the No. 50 universal gear chamfering machine in an illustrated folder.

INSTRUMENTS Bulletin No. GEA-3187A, published by General Electric Co., Schenectady, N. Y., provides eight pages of specifications concerning the Type CF-1 portable inkless strip-chart recorder.

LABORATORY EQUIPMENT Precision Scientific Co., 1730 N. Springfield Ave., Chicago, Ill., discusses characteristics and applications of various types of precision instruments in an eight-page illustrated bulletin, No. 305, entitled "What to Think About When You Buy Constant Temperature Laboratory Equipment."

LADDERS Aluminum Ladder Co., 104 Adams St., Tarentum, Pa., has issued a 24-page illustrated catalog entitled "Aluminum Ladders for Every Requirement."

MOTORS Form No. 938 A, issued by Century Electric Co., St. Louis, Mo., provides 12 pages of information concerning a line of brush-lifting repulsion-start single-phase induction motors.

MOTORS Type KH, 1/60–1/3 hp. split-phase motors are discussed in an eight-page illustrated bulletin, No. GEA-1276D, published by General Electric Co., Schenectady, N. Y.

PLATING A folder available from the Electroplating Division of E. I. du Pont de Nemours & Co., Wilmington, Del., provides data concerning the "Moly-Black" molybdenum-nickel electroplating process.

PORTABLE TOOLS Savings possible through applications of various types of portable tools are discussed in a twelve-page booklet, "A True Gold Mine," offered by Rotor Tool Co., 17325 Euclid Ave., Cleveland, Ohio.

PUMPS Bulletin No. 260-B11D, issued by the Turbine Pump Division of Roots-Connersville Blower Corporation, Connersville, Ind., discusses a line of turbine pumps designed for handling liquids at temperatures up to 210 F.

RECTIFIERS Bulletin RC1-18, published by Cassels Engineering & Machine Co., Box 114, Wauwatosa, Wis., describes "Porto-Rect" power rectifiers for speed control and magnetic devices.

SAFETY Davis Emergency Equipment Co., 55 Van Dam St., New York, N. Y., has issued a catalog comprising a handbook of industrial first-aid supplies.

SANDING Several models of the "Wet-r-Dry" sander-grinder are described in an illustrated leaflet issued by Porter-Cable Machine Co., 1714 N. Salina St., Syracuse, N. Y.

SAW An eight-page illustrated folder offered by Racine Tool & Machine Co., 1751 State St., Racine, Wis., discusses features of the "Shear Cut" high-speed power-driven hacksaw.

SAW "Speedmatic" portable saws are described in a 6-page illustrated folder, Form No. 459-A, released by Porter-Cable Machine Co., 1714 N. Salina St., Syracuse, N. Y.

SEGMENT SAW The Pittsburgh Saw & Tool Co., 75 Sycamore St., Etna Post Office, Pittsburgh, Pa., has published an eight-page catalog describing the recently developed segment saw in which each segment is held to the saw plate with a tongue-and-groove and wedges.

SHEET METAL TOOLS Catalog No. 40, published by J. F. Kidder Mfg. Co., Inc., 426 Colchester Ave., Burlington, Vt., lists a number of bench-type sheet metal working tools of various capacities.

Consider Labor Costs When Buying Steel

On most jobs, shop labor costs are the biggest single factor—and they depend to a large degree on the steel used. If bars are too hard for bending or forming—or have hard spots to break or dull tools—if some shapes are not straight—or if in the case of alloy steel the required properties are not developed by the first heat treatment—then up go costs, down go profits.

Purchasing steel that is uniform and has the properties most desirable for your particular use often pays big dividends in the form of decreased shop costs. You do not have to pay any more for this kind of steel—so why not get it?

For several years Ryerson has been building up stocks of these better, more uniform steels. Careful selection, checking, testing, and inspecting assure the uniform high quality necessary for Ryerson Certification. Try Ryerson Certified Steels on your hardest job—and check the labor costs. Many have told us that it pays.

JOSEPH T. RYERSON & SON, INC. *Plants at:* Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.

RYERSON *Certified* STEELS

RYERSON CERTIFIED STEELS

SPEEDOMAX Bulletin N-33B-635(1) published by Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa., describes the redesigned "Speedomax" instrument for recording the temperatures of billets, slabs, rails, sheets, strips, rods and plates while actually on the rolls.

SWITCHES General Electric Co., Schenectady, N. Y., provides design data and specifications of a line of limit switches especially designed for machine tool applications in a four-page illustrated leaflet, No. GEA-3043.

TOOLS Complete specifications of an extensive line of drills, taps, reamers and other metal-cutting tools are contained in a 36-page illustrated catalog, No. 40, issued by Falcon Tool Co., Greiner at Hamburg, Detroit, Mich.

VOLTAGE REGULATORS Sixteen pages of information concerning Type GDD "Diactor" generator voltage regulators for d.c. machines are provided in an illustrated bulletin, No. GEA-2150B, available from General Electric Co., Schenectady, N. Y.

WELDING Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio, describes featuers of its Type S-6055, 300-amp., "Shield-Arc" diesel-driven welder, in Welder Specification Bulletin No. 327A.

WELDING General Electric Co., Schenectady, N. Y., discusses features and characteristics of "Ignitron" contractors for spot and projection welding in an eight-page illustrated bulletin, No. GEA-3058A.

TO THE EDITOR

Waste Manpower

Dear Sir:

I believe that the man who operates a machine is as great an asset to industry as the machine itself, and I am constantly impressed by the shortsighted attitude of business executives in regard to the supply of skilled labor.

Many sections of the country are not served by vocational and trade schools, and in these "barren sections" the selfish failure of industrial concerns to provide opportunity for the training of young men forms a part of the social-economic problem. It seems almost naive that the same brains that will "hydrogencool" the equipment of a power plant because it gives them a one per cent increase in efficiency over air-cooling, will ignore or tolerate the waste occasioned by millions of unemployed.

Sincerely yours,

L. S. MUSHKAT,

Glace Bay, Nova Scotia, Canada.

NEW BOOKS

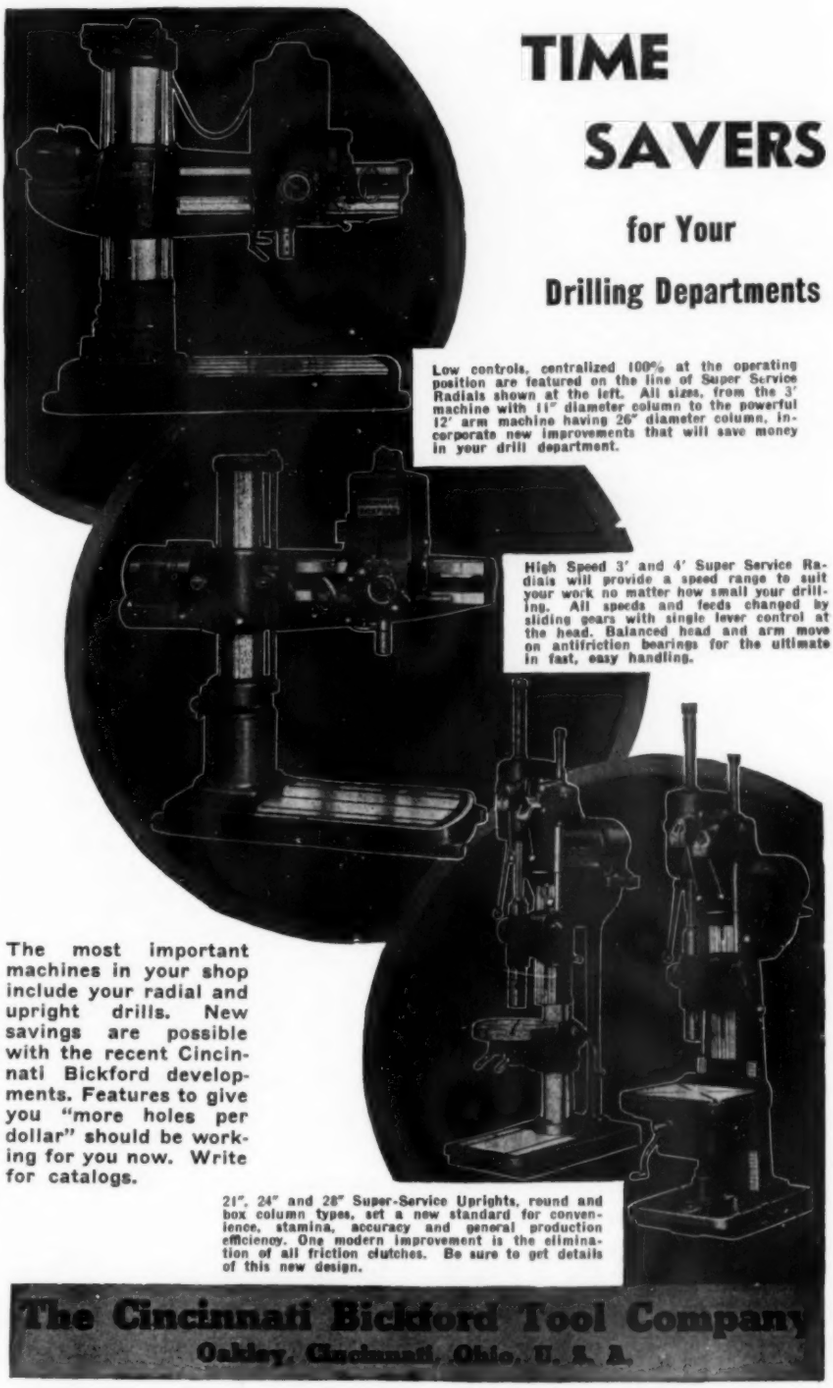
PATENT FUNDAMENTALS—*By Adelbert Schapp, patent attorney. 176 pages. Published by the Industrial Press, 148 Lafayette St., New York City.* $2.

In recent years there has been considerable criticism of our patent system both by public officials and private individuals. A good deal of this criticism on the face of it reflects a vague or incomplete knowledge of exactly what a patent is and what patent protection is intended to accomplish.

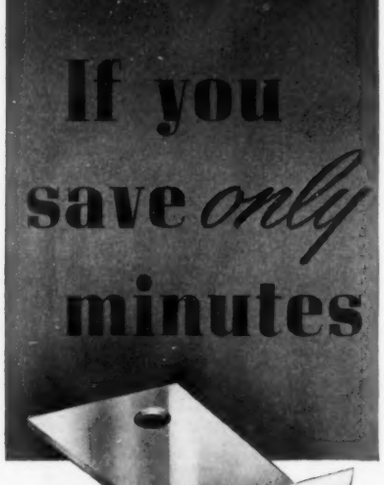
Inventors sometimes fail to receive patents to which they think they are entitled or fail to obtain proper protection through patents which are granted them. Executives are frequently called upon to make important decisions based on patent rights without knowing all the conditions and limitations that surround a patent.

In this volume the author explains in non-technical language the underlying principles of invention and patent protection so the student, inventor and executive can fully acquaint themselves as to what these subjects are all about.

This is not to say that an institution as old as the Patent Office is not


TIME
SAVERS
for Your
Drilling Departments
Low controls, centralized 100% at the operating position are featured on the line of Super Service Radials shown at the left. All sizes, from the 3' machine with 11" diameter column to the powerful 12' arm machine having 26" diameter column, incorporate new improvements that will save money in your drill department.
High Speed 3' and 4' Super Service Radials will provide a speed range to suit your work no matter how small your drilling. All speeds and feeds changed by sliding gears with single lever control at the head. Balanced head and arm move on antifriction bearings for the ultimate in fast, easy handling.
The most important machines in your shop include your radial and upright drills. New savings are possible with the recent Cincinnati Bickford developments. Features to give you "more holes per dollar" should be working for you now. Write for catalogs.
21", 24" and 28" Super-Service Uprights, round and box column types, set a new standard for convenience, stamina, accuracy and general production efficiency. One modern improvement is the elimination of all friction clutches. Be sure to get details of this new design.
The Cincinnati Bickford Tool Company
Oakley, Cincinnati, Ohio, U. S. A.

If you save *only* minutes



. . . WORTH saving . . . in assembly or service adjustments! In machine tool assembly (where *accuracy* is paramount), Laminum shims not only reduce labor . . . they afford a precision which makes older methods a costly luxury. Simply *peel* known gage laminations from the solid brass shim!

Laminum shims cut to specifications. Stock shim materials sold by mill supply dealers.

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Write for file-folder of shim application photos—with Laminum sample.

LAMINUM
THE SOLID SHIM THAT peels FOR ADJUSTMENT
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subject to change in the light of rapid industrial growth. However, many of the proposals that are tossed out today would be far more intelligent were they based on some of the information which this volume affords.

•

SCIENCE FOR HANDICRAFT STUDENTS—*By H. Morton. 149 pages. Distributed by Chemical Publishing Co., 148 Lafayette St., New York City.* $3.

This textbook for handicraft students, written by an Englishman, sets forth clearly the scientific principles underlying metal and wood craftsmanship. Especially are the principles applied to workshop practice. Such subjects as measurements, elasticity, properties of materials, machines, hydrostatics, the electric circuit, and friction and work are dealt with in separate chapters. The book contains a profusion of diagrams and drawings which are easily understood. Included in the book are experiments which can be performed in some cases with improvised apparatus, and in others with simple working models which can be built by the student. At the end of each chapter are suitable exercises. The book is based on the syllabus in elementary science for the First Handicraft Teachers' Examination of the City and Guilds of London Institute, though the scope is not confined to the requirements of that examination.

SEEN and HEARD

JOHN R. GODFREY

Value Added

Even high priced materials have little effect on the cost of some mechanisms. In an instrument shop recently a batch of pinions represented over $40,000 at the list price of parts The material cost was less than a dollar for the lot. The value was added by the thousands of hours of labor in producing these pinions to the required accuracy. It's the same with many kinds of accurate machinery or parts, which is why estimating values by weight has too many variables to be of much value.

Used Machines Have Their Place

"Some of us" said the builder of machines for various purposes, "have the mistaken notion that the sale of a used machine kills an order for a new one. Nothing could be further from the facts. It's much the same as with automobiles. If there were no trade-ins on cars that have been run from one to five years, it would put a crimp in new car sales that would change the complexion of all automobile production schedules."

While the comparison of automobiles and machine tools isn't exactly a par proposition, there is enough to make it worth looking into. Many a small jobbing shop that has made good could not have started had it been obliged to buy all new machines. The companies which sold the machines might not have been able to buy new tools for their own shops.

As with automobiles, most machine tools have a lot of work capacity left in them for those who can utilize it. Mass production and ultra precision work need the best and newest machines available. But many a small shop makes a good living for its owner, and gives real service in its community, with machines that have seen service in other shops.

Turning the Tables

When we first began to grind shafts as a commercial shop operation we accepted rough turned shafts to save a second turning. Now we are reversing this practice by turning rear axle drive pinions so accurately that a first grind is eliminated. Carbide tools do the trick, leaving the blank so true that it is not ground at all until after hardening.

Molded Gun Stocks

Wood has withstood all efforts to displace it as a material for gun stocks until very recently. Those who recall the hectic days when we made rifles by the millions for Russia and other Allies and tried in many ways to introduce one of the early plastics, such as Micarta, in this job, but without success. Wood reigned supreme and even the hand sandpapering clung to us during the war. Few realized the work on these stocks, the old Springfield rifle stock requiring 35 operations and the hand guard 14, a total of 49. Now we have a material, Tenite, that is being accepted by gun makers, which can be molded almost complete, which does not change shape and which saves a lot of work and time. It's a big step in the right direction.

Testing Iron by Torsion

BY H. M. LANE

Soon after 1870, the two Buckeye plants, one located in Akron, Ohio, and the other at Canton, Ohio, decided to add to the line of agricultural implements which they made—a steam thrashing engine that could propel itself along the road and draw after it the thrashing machine or separator, the water tank, and any other equipment that might be required. The engines were to be made at the Canton Plant, where the thrashers were manufactured, but the engineering staffs of the two plants were working together. The owners of the two plants belonged to the same family.

My mothers cousin, Julian Pitkin,

was at the time in charge of the Akron Plant.

Soon after the first engines were made, a serious difficulty developed. The power was transmitted to the wheels by a cast iron internal gear attached to one of the rear wheels. From memory, I should say that this gear was at least 5 ft. inside diameter, and the face width of the gear about 4 in. The teeth were about 1¼ in. circular pitch.

The pinion was about 5½ in. in diameter and extended into the bull wheel, as it was called, at the top. The section of the country, where these engines were first put to work, was quite hilly, and everywhere, there were plenty of bad chuck holes in the roads in use at that time.

With the grade of cast iron available, the bull wheel rings kept breaking. I have known them to break three rings on one bad hill.

To overcome this and to get some high strength iron my father wanted for some of his clay working and mining machinery, Cousin Julian and my father started a research to develop such an iron.

First they wanted some kind of a yardstick to compare one iron with another. There were no commercial testing machines on the market, and outside of some crude machines developed by Franklin Institute, in Philadelphia, and by Government arms plants, there were no testing machines of any kind available.

With this virgin field before them, they finally decided on a torsion test. The test bars were 6 in. long and 1 in. square on each end for 1 in. in length. The 4 in. in the center of the bar was round, and the diameter at the center was reduced to some definite part of a square inch, either ¼ or ½ in. in area.

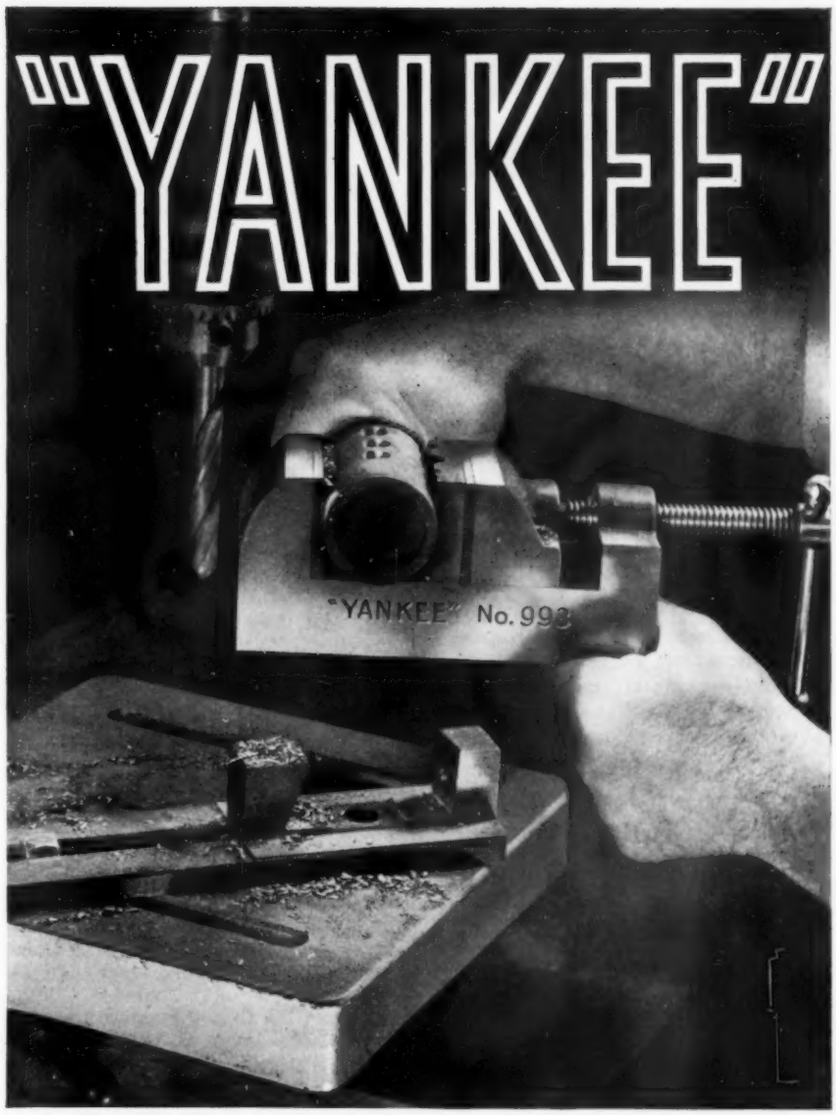
The bars were cast horizontally and parted in the mold through two diagonally opposite corners.

For the testing, one end of the bar was put in a vise. Behind the vise was arranged an arc with a graduated scale on it. To twist the bar a solid end wrench was used with a plate over one side of the opening, so that when it rested on the top of the bar the end of the wrench came over the scale. The graduation on the scale could be shifted to bring the zero point under the pointer at the end of the bar.

The specimen was twisted off by pulling on the lever. With ordinary cast iron mixtures, the specimen twisted off with a small travel of the pointer on the end of the wrench.

By adding a mixture of cast iron and wrought iron that had been previously melted and pigged out, the strength was greatly increased, but they wanted still more strength, and so they developed a secret process of making what they called "strong iron."

The process was kept a strict secret for many years, and was only used in the plant of the Akron Buckeye and



VISE and VISE CLAMP

"YANKEE" Vises and Vise Clamps are made to work together—for more accurate results in less time. Work can be kept in alignment for a series of jobs. The clamp holds Vise rigidly for machining operations. Its long slotted body makes for quick and easy adjustment of work on Drill Press table. Vise illustrated available in four sizes: No. 991; 1½" jaw width. No. 992; 2" jaw width. No. 993; 2¾" jaw width. No. 994; 4" jaw width. "Yankee" Vise Clamp made in two sizes only: Clamp No. 2992, length 9¾", for Vise No. 992. Clamp No. 2993, length, 10½", for Vise No. 993.

This "Yankee" Clamp easily attaches "Yankee" Vise to face plate. Assures rigidity and accuracy, in holding work for drilling and machining operations

ORDER FROM YOUR SUPPLY HOUSE. FOR "YANKEE" VISE CIRCULAR, WRITE NORTH BROS. MFG. CO., DEPT. AM, PHILADELPHIA, U.S.A.

NORTH BROS. MFG. CO., PHILADELPHIA, U.S.A.

DoAll SAVED 22½ HOURS

Northwest Airlines, Inc., of St. Paul, Minn., made this special Wrench from chromally steel in 80 minutes on the DoAll, 40 minutes for sawing, 40 minutes for filing. Outside dimensions are 24" long, 18" wide. Former time was 24 hours burning, milling, shaping and sanding.

STARTLING RESULTS

Contour Sawing, the new DoAll process of machining is recognized as the fastest precision method of removing metal; cuts out internal and external shapes from any metal up to 10" thick.

Does work of 3 machines. DoAll is a moderately priced, rugged precision machine tool that replaces shaping, milling and lathe work on a large variety of jobs with enormous savings.

Used in large and small plants in 30 countries by such firms as General Electric, Ford, Douglas Aircraft, Foster Machine, C. M. St. P. & P. R. R., Radio Condensor, Corey Steel, Baldwin Locomotive, Ferro Stamping, Underwood Elliott Fisher, etc.

Let a factory trained man bring a DoAll to your plant and show you what it does, what it saves on your own work.

FREE —
New Handbook on Contour Machining—158 pages of valuable metal working helps.

CONTINENTAL MACHINES, INC.
1310 S. Washington Ave. Minneapolis, Minn.

☐ Send data on the DoAll AM-3
☐ Send Free Handbook

Name.....

Address.....

in my father's shop—the Webster, Camp & Lane Foundry and Machine Company.

Test bars cast from this mixture twisted several degrees before breaking, and it was also possible to detect the yield point before the actual break, and this yield point, as well as the breaking point, were entered on the records.

The strong iron solved the bull wheel problem, and no more breaks occurred.

It also gave strong gears and other special castings that my father required for his line of machinery.

Training Mechanics In the Small Shop

Every shop owner wants more trained mechanics, but he usually wants the other shop to do the training. But if we depend only on shops big enough to have regular apprentice training courses, we are not going to have enough trained men.

While regular courses of instruction are not easy in the small shop, nearly all can arrange a general plan that will give a boy or young man a foundation of the things he must learn about the machines he is to operate. Sweeping the shop, snagging castings or nursing a bolt cutter used to be the usual introduction to shop work in the old apprentice systems. These tasks wasted a lot of the boy's time and added little to his knowledge of the shop.

One of the first things an apprentice should know is not only *how* machines operate, but *why*. Many good lathe operators fight shy of transfer to a milling machine, gear cutter or other machine. This handicaps the shop as well as themselves at times. If they had been shown *why* as well as *how* machines operate, they would know that screws and gears act in the same way, no matter what kind of a machine uses them.

General knowledge of machines and machine fits also helps. One railroad master mechanic started his boys as helpers with the erecting gang. They learned the names of parts, where they went and the kind of fit needed. When they learned to make these parts they knew better than to waste time on a fine fit where it was not needed, and to make real fits as they should be. After a bright boy has been soaking up general information of this kind for a month or so, he will learn operations a lot faster than the lad who doesn't know what tools are used for.

Arbitrary age limits for learners often work to the disadvantage of all concerned. Many men with mechanical leanings had no opportunity to learn the trade when young. Such men often make good mechanics if given the opportunity. Frequently their experience with life itself is an asset in adapting themselves to new surroundings. The last war taught us that men (and women) could be made into good operators in a few weeks.

Small shops naturally have limited facilities for training. On the other hand a small shop with a wide variety of work, often gives more opportunity for exercising mechanical ability and judgment than where machines are available to handle any job that comes along. Small shops can have a more effective program than haphazard allocation of work. Such a program must of necessity be flexible, but should contain basic information as to cutting tools, speeds and feeds, care of machines, different kinds of fits, and many other features of shop work. An important accomplishment is to know when to work to thousandths and when sixteenths is close enough. Though tolerances are specified on many jobs, the small shop man must frequently depend on his own judgment.

In fact, good judgment is one of the best assets a mechanic can have. Even in a large shop, where work is laid out by the designer and the planning department, the mechanic with good judgment has many opportunities to prove his value. He can frequently prevent substantial losses and is excellent material for foremanship.

Piece Rates for Flame Cutting

By ED WEST

Cutting metal with acetylene flame is becoming more and more an accurate process as time goes on. One shop that we know of cuts steel plate into complicated shapes to accuracies of ± $\frac{1}{32}$ in. The supervisor told us that if he could buy a flame-cutting machine which was more rigid and was as accurately made as some precision machine tools he could do even better than that. In fact, he said that he was looking for such a machine so that he could get a fine accurate flame finish and eliminate some machining jobs.

When this shop first started using flame-cut parts the operation was fairly slow. High-grade expensive labor was used and a minimum of inspection was required. However, when it was decided to pay piece rates it was found necessary to add more inspectors because production became faster and more careful check against errors was required. This problem was solved by equipping the machine with a magnetic tracer and using metal templets for every possible job. Production was improved, but it was possible to reduce the number of inspectors. All that was necessary was a first check of the templet and occasional check of the pieces to see that the templet was being followed by the machine.